SYNTAX AND SEMANTICS OF PATH-DENOTING PARTICLES AND PREPOSITIONAL PHRASES IN GERMAN

BY

JAMES PATRICK WITTE

B.A., University of Nebraska, 1989
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Georgia Green — Director of Thesis Research

U. Henry Gerlach — Head of Department

Committee on Final Examination†

Chairperson

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SYNTAX AND SEMANTICS OF PATH-DENOTING PARTICLES AND PREPOSITIONAL PHRASES IN GERMAN

James Patrick Witte, Ph.D.
Department of Germanic Languages and Literatures
University of Illinois at Urbana-Champaign, 2001
Prof. Georgia M. Green / Prof. Elmer H. Antonsen, Advisors

This thesis analyzes the syntactic and semantic structure of German path-denoting expressions in combination with motion verbs. Path-denoting expressions include path-denoting prepositional phrases and path particles (separable prefixes). Descriptions of syntactic and semantic structure are formalized within the framework of Head Driven Phrase Structure Grammar (HPSG). I conclude that combinations of path-denoting particles with motion verbs are best regarded as phrases, rather than discontinuous words. Path-denoting particles are a type of adverbial. The distribution of both path particles and path-denoting prepositional phrases is determined by their semantic content and grammatical relation to the motion verb. The grammatical relation between a path expression and the motion verb is either that of complement to head, or adjunct to head. Exactly one path expression occurring with a motion verb is a complement. All other path expressions (if any) are adjuncts. Many particles only occur as complements, but a few may occur as either complements or adjuncts. Path-denoting prepositional phrases occur freely as either complements or adjuncts. Semantically, path expressions are referential, denoting a stretch of space, and are defined with respect to locations. An analysis of semantic selection of path expressions by motion verbs is presented, as well as an account for the Unique Path Constraint, which specifies that all path expressions occurring with a single verb head must describe the same stretch of space.

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Chapter 1: Introduction

1.0 The problem

This thesis aims to provide a syntactic and semantic description for path-denoting particles with motion verbs in German, within the larger context of an analysis of German path-denoting expressions with motion verbs in general. Path-denoting expressions refer to a continuous stretch of space. Path-expressions in German take the form of prepositional phrases or particle phrases. Sentences (1.1a-e) show examples of path-expressions in German, and demonstrate the range of data that this thesis will discuss. In sentence (1.1a), the motion verb *reist* 'travels' occurs with the path particle *ab* 'off, away'. In general, no more than one path particle occurs in a single clause.[1] Sentence (1.1b) shows the same verb and particle combination in a subordinate clause, where the verb occurs in clause-final position. The particle immediately precedes the verb, and is written adjoined to the verb without a space, in accord with current standard German orthography. In general, when a finite main verb occupies first or second position in a sentence, as in sentence (1.1a), the particle occurs at the end of the clause. Otherwise, the main verb will occur at the end of the clause, and the particle will immediately precede the verb.[2]

(1.1a) Peter reist heute abend ab.
Peter travels today evening away
Peter is departing this evening

---

[1]Particles in general (not just path particles) almost always occur singly in a sentence, although sentences like (1.1) may be exceptions, depending on the analysis of *mit* 'with':

(1.1) die Regierung wird die Übergriffe nicht länger mit ansehen
the government will the incursions no longer with on-see
The government will no longer stand by and watch these incursions.

[2]I owe this succinct description of particle word order to Uszkoreit 1987.

(1.1b) ...daß Peter heute abend abreist
...that Peter today evening away-travels
--- that Peter is departing this evening

Sentence (1.1c) shows the cause-motion verb *warf* 'threw' with the prepositional phrase *ins Zimmer* 'into the room'. Sentence (1.1d) shows the same sentence with the addition of the particle *hinein* 'in'. Path-denoting prepositional phrases and particles interact in interesting ways to specify paths of motion.

(1.1c) Maria warf den Ball ins Zimmer
Maria threw the ball into-the room
Maria threw the ball into the room

(1.1d) Maria warf den Ball ins Zimmer hinein
Maria threw the ball into-the room in
Maria threw the ball into the room

The interaction of path particles and prepositional phrases is similar to that of multiple prepositional phrases, as in sentence (1.1e).

(1.1e) Anna lief von der Bibliothek durch das Feld nach Hause
Anna ran from the library through the field to home
Anna ran home from the library through the field

1.1 Definition of *path particle*

In this thesis, the term *path particle* refers to the closed class of words which denote a path relation of some sort, do not take complements, and occur immediately preceding the finite verb when the verb occupies clause-final position, otherwise occurring in clause-final position. Path particles are clearly distinct from path-denoting prepositions, which take NP complements. Word order constraints, along with certain other criteria distinguish particles from path-denoting adverbs like *südlich* 'south, in a southerly

direction' or *links* 'left'. Chapter 3 provides an explicit definition of the class of path particles, and supplies a listing of all German path particles.

Certain German expressions that do not denote paths resemble the path particle expressions of interest in this thesis. The relationship between these similar expressions and path-expressions will not be explored in this thesis. The underlined words in examples (1.2a-c) are sometimes considered particles (Uszkoreit 1987)[3] In sentence (1.2a), *Rad* 'bike' is a determinerless uninflected noun. In (1.2b), *sauber* 'clean' is an unmodified, uninflected adjective.

(1.2a) Peter wird Rad fahren
Peter will bike ride
Peter will go bike-riding

(1.2b) Peter wird das Haus sauber machen
Peter will the house clean make
Peter will clean the house

Inconsistant and sometimes unintuitive spelling rules for particle verb combinations are most responsible for confusion about the proper definition of particles. The official spelling of sentences like (2a) and (2b) has changed since Uskoreit gave these example sentences in 1987. Determinerless nominals like *Rad* are now consistently written separate from the verb, and capitalized like most German nouns. Unmodified adjectivals like *sauber* are now written separate from the verb as well.[4] These spelling changes reflect the confusion that many German speakers have with respect to the question "are particles words, or word parts?" Of course, spelling by itself does not determine what the simplest linguistic analysis will be. The spelling of certain other combinations of particles with verbs

[3]Uszkoreit uses the traditional English term *separable prefix*

[4]Adjectives that can modified or form comparatives are written separately

remains unchanged. In sentence (1.2c), the particle *auf* 'up', contributing a perfective aspect, is adjoined to the verb when it immediately precedes the verb.

(1.2c) Peter wird den Teller nicht aufessen
Peter will the plate not up-eat
Peter will not eat everything on his plate

1.2 Path particles and path prepositions

There are several reasons to study path particles in the larger context of path-expressions and motion verbs. First, path particles express similar kinds of semantic relations as do path prepositions. For example, the particle *hinaus* 'out, away from speaker' and the preposition *aus* 'out' share the *out* relation. The semantic analysis of path-denoting particles and path-denoting prepositions are therefore very similar. Not all path particles have a path prepositional counterpart, nor do all path prepositions have a path particle counterpart. For example, the particle *entgegen* 'toward' has no prepositional counterpart, and the path preposition *von* 'from' has no particle counterpart.

A second reason to study path particles along with path prepositions is that path particles and path prepositions have similar (but not identical) distributions. Both path particles and path prepositions generally occur with motion verbs, such as *laufen* 'run', *werfen* 'throw', *stellen* 'put, place', although the type of path relation that can occur with certain verbs is restricted. For example, sentences (1.2a-b) show that *stellen* 'put, place' occurs with prepositional phrases like *auf den Tisch* 'on the table', but not with prepositional phrases like *von dem Boden* 'from the floor'.

(1.3a) Maria stellte die Vase auf den Tisch
Maria placed the vase on the table
Maria placed the vase on the table

(1.3b) *Maria stellte die Vase von dem Boden
*Maria placed the vase from the floor

Not only do path particles and path prepositional phrases occur with the same sorts of verbs, they often occur with a single motion verb at the same time, as in (1.4).

(1.4a) Anna lief aus dem Haus hinaus
Anna ran out the house out
Anna ran out of the house

In order to understand how path particles and path prepositions interact to specify path of motion, it is necessary to study them together. In (1.4), the prepositional phrase *aus dem Haus* occurs with the particle *hinaus*.

1.3 Main features of the proposed analysis

Formal descriptions of the structures discussed in this thesis will be presented in the HPSG (Head-driven Phrase Structure Grammar) framework, as put forth in Pollard and Sag (1994). Chapter 2 presents an overview of HPSG concepts which are relevant to this thesis.

The following sections (1.3.1-1.3.5) summarize the main points of the thesis and the significance of these points.

1.3.1 Path particles combine with verbs to form phrases, not words

One of the reasons that German particles are intriguing objects of study is that path particles are sometimes analyzed as independent words (Uszkoreit 1987, Anderson 1992) , sometimes as word formation elements (Olsen 1997, Piñon 1992, Brehmer 1985). Supporting the One-Word view is the fact that some combinations of particles with verbs

are active in German word formation, especially in forming nouns. For example, the noun *Abreise* 'departure' derives from the combination *ab+reisen* 'to travel away, to depart'. Olsen (1997) argues that the combination of *reisen* and *ab* is a word, not a phrase, because her theory of morphology does not admit the possibility that words (like the noun *Abreise*) can be derived from phrases, even though a few counter-examples clearly exist, like *das auf-dem-Stein-sitzen* 'the sitting on the stone' (Uszkoreit 1987). Another piece of evidence often cited in defense of the One-Word view is the fact that many combinations of particles with verbs have acquired lexicalized meanings that are not completely predictable from the individual meanings of the particle and verb. For example, the meaning of the combination *auf+hören* 'to stop, cease', is apparently unrelated to the meanings of *auf* 'up' and *hören* 'to hear'. To give a path-denoting example, the combination *weg+werfen* 'throw away' has in addition to its literal meaning 'cause to move away by throwing' a lexicalized meaning of 'discard'. However, non-compositionality is not the exclusive province of word formation. For example, the phrase *Hans gibt den Löffel ab* 'Hans gives the spoon away' (Krenn and Erbach 1994) has an idiomatic interpretation that means 'Hans dies'. The idiomatic reading is partially motivated by the literal meaning of the sentence, but certainly not predictable from it. Chapter 3 argues that combinations of a motion verb with a path-denoting particle as in examples (1.5a-b) are licensed by syntactic and semantic principles, rather than principles of word formation. Thus, forms like *abreist* 'away-travels' in (1.5b) are phrases, in this case consisting of two words. The fact that the particle and the verb are sometimes written together without a space is of little significance.

(1.5a) Peter reist heute abend ab
Peter travels today evening away
Peter is departing this evening

(1.5b) ... daß Peter heute abend abreist
... that Peter today evening away-travels
... that Peter is departing this evening

The claim that combinations of particles (including path particles) with verbs are phrasal is by no means new, but chapter 3 provides a good overview of current arguments, and provides evidence for the phrasal argument not found elsewhere.

1.3.2 The class of path particles constitutes a distinct part of speech

Path particles form a distinct part of speech. Although path particles are most closely related morphologically and etymologically to prepositions, path particles are clearly distinct from prepositions. Chapter 3 argues that path particles form a lexical category (called *path_particle*), distinct from path-denoting prepositions and path-denoting adverbs. I assume that a broader class *particle* exists for German, but this class will remain undefined. Developing detailed criteria to classify the various parts of speech is beyond the scope of this thesis.

1.3.3 Grammatical relation between path-expression and motion verb

Chapter 4 argues that a single path-expression occurring with a motion verb is a complement. For example, the path-expression *auf den Tisch* 'on the table' and the path particle *hinaus* in examples (1.6a-b) are both complements of the verb *sprang* 'jumped'.

(1.6a) Die Katze sprang auf den Tisch
The cat jumped on the table
The cat jumped on the table

(1.6b) Die Katze sprang hinaus
The cat jumped out
The cat jumped out

Two main points follow from the complementhood of these path-expressions. First, it means that encoded within the lexical representation of a verb (within its lexical entry) is the fact that the verb requires a path-expression to form grammatical sentences. This requirement is easy to demonstrate for verbs of placement like *stellen* 'put, place', which may not occur without a path-expression, as shown by sentences (1.7a-b).

(1.7a) Maria stellte das Buch auf den Tisch
Maria placed the book on the table
Maria placed the book on the table

(1.7b) *Maria stellte das Buch
Maria placed the book

It is less easy to demonstrate that paths are required for manner of motion verbs like *laufen* 'run', or for caused-motion verbs like *werfen* 'throw'. As in English, you can *run to the store*, or you can simply *run*. Chapter 4 will argue that the lexical entry for *laufen* in sentences like *Maria lief* 'Maria ran' is distinct from the lexical entry for *laufen* occurring with path-expressions, as in *Maria lief aus dem Haus* 'Maria ran out of the house'.

Being a complement also has consequences for the semantic representation. The semantic content of the complement is identified with a role in the semantic relation of the head. For example, the verb *stellen* 'put; place' denotes a kind of *put* relation (a *put_rel*), relating an acting agent, an entity which gets put somewhere, and a path of motion. In sentence (1.8a), the semantic content of *auf den Tisch* 'on the table' is identified with the path role in the *stellen_rel,* the 'put' relation. Chapter 5 will provide a representation of motion verb relations, and present an account of how path-expressions

and motion verbs contribute to the semantic content of the phrases they form.

1.3.4 Grammatical relations for multiple path-expressions with motion verbs

Chapter 4 argues that in sentences like (1.8a) where multiple path-expressions occur with a single verb, one path expression is a complement sister of the verb, and other path-expressions are adjuncts to the verb phrase. In (1.8a), either *über die Straße* 'across the street' or *hinter das Haus* 'behind the house' is a complement sister of the verb *lief* 'ran'. Chapter 4 argues that the structure of this sentence is ambiguous, depending on which prepositional phrase is the complement.

(1.8a) Peter lief über die Straße hinter das Haus
Peter ran across the street behind the house
Peter ran across the street behind the house

While the structure of sentences with multiple path-denoting prepositional phrases is ambiguous, the structure of sentences containing a path-denoting particles is not ambigious. In sentence (1.8b), the particle *hinaus* 'out' is the required complement, and the prepositional phrase *aus dem Haus* 'out of the house' is an adjunct.

(1.8b) Peter lief aus dem Haus hinaus
Peter ran out the house out
Peter ran out of the house

Chapter 4 argues that the lexical entries of path-denoting prepositional phrases allow them to occur as either complements or adjuncts of motion verbs, but the lexical entries of path particles allow them to occur as complements, but not adjuncts. Because motion verbs select just one path-denoting complement, it is correctly predicted that no more than one path particle may occur with a single motion verb.

1.3.5 Semantic representation of path and motion relations

Chapter 5 is concerned with presenting a semantic analysis for path-expressions with motion verbs. It is argued that path relations are defined with respect to locations, and locations in turn are defined with respect to entities. A path-expression refers to a continuous stretch of space. In example (1.9), the path *in das Haus* 'into the house' refers to some continuous stretch of space that terminates inside the house.

(1.9) Maria lief in das Haus
Maria ran in the house
Maria ran into the house

Multiple path-expressions occurring with a single motion verb are subject to the Unique Path Constraint, which specifies that all path-expressions describe (different) aspects of a unique path. The Unique Path Constraint is a semantic constraint, a consequence of the definition of the motion relation described in chapter 5. In example (1.10), both *aus dem Haus* 'out of the house' and *in den Garten* 'into the yard' describe different aspects of the unique, definite path along which Hans moved.

(1.10) Hans lief aus dem Haus in den Garten
Hans ran out the house in the yard
Hans ran out of the house into the yard

Chapter 5 represents this constraint by coindexing the PATH feature in each path relation and the motion relation. The notions of path relations and path reference play a defining role in semantic relations for motion verbs and path-denoting particles and prepositions. The value of the GND role in the verb's semantic relation corresponds to the unique path of motion followed by the moving entity, rather than to the indefinite reference of any individual path-expression.

For manner of motion verbs like *laufen* 'run', and cause-motion verbs like *werfen* 'throw', constraints on possible combinations of path expressions follow from the definition of a path and the logical constraints of the real world. Sentences like example (1.11) are not possible because a continuous stretch of space can have just one endpoint.

(1.11) *Hans lief zur Bank zur Post
Hans ran to-the bank to-the post office

Placement verbs like *legen* 'lay' impose constraints on path combinations beyond those dictated by the definition of a path. Sentences like example (1.12) are not possible. Chapter 5 presents an analysis of the semantic selection exhibited by placement verbs which exploits the hierarchy of semantic relation types.

(1.12) *Hans legte das Buch vom Boden
Hans laid the book from-the floor

1.4 Structure of the thesis

Chapter 2 summarizes key HPSG ideas, swo that the non-specialist will be able to appreciate most of the formal representations provided in this thesis. Topics include multiple inheritance hierarchies, grammatical relations, phrase types, the head feature principle, the semantics principle, semantic relations, and an introduction to reading attribute value matrices (AVMs).

Chapter 3 argues that particles (including path particles) are independent words because this analysis better predicts the distribution and occurrence of the *ge-* past participle prefix, the *zu* infinitival marker, and better explains how particles are licensed to occur separated from the verb. Chapter 3 also explicitly defines the word type *path*

particle, and provides a list of path particles.

Chapter 4 presents grammatical relations and phrase structure for path-expressions with motion verbs. It is argued that path-denoting prepositional phrases may occur as complements or adjuncts, but path particles only occur as complements. This analysis accounts for the fact that single path expressions are often required, but additional path-expressions with the same motion verb are always optional. This analysis also correctly predicts that no more than one path particle may occur with a motion verb.

Chapter 5 is chiefly concerned with semantic representations of path-expressions and motion verbs and the phrases of which they are part. An analysis of the Unique Path Constraint is given, as well as an account of the constraints on combinations of path-expressions.

Chapter 6 concludes the thesis. Section 6.0 summaries the arguments and conclusions of chapters 3 through 6. Section 6.1 summaries the research contributions of the thesis, and explores possibilities for further research. Section 6.2 offers speculation on a few unanswered questions. Section 6.3 offers a few closing remarks.

Chapter 2: Introduction to HPSG

2.0 Generative linguistics

This thesis is a contribution to the approach to linguistics that investigates natural language by providing explicit descriptions, or grammars, of particular languages, and by providing a general theory for writing these grammars.[1] Head-driven Phrase Structure Grammar (HPSG) is the formal framework for writing grammars used in this thesis. Other generative theories of grammar include Government & Binding (GB), Lexical-functional Grammar (LFG), and Arc-Pair Grammar. All theories of generative grammar rely on (partial) descriptions of natural languages, as these descriptions either confirm that the theory is adequate to the task, or demonstrate that the theory must be revised.

Natural languages are languages like American Sign Language, Chinese, English, or German. Generative study concerns itself mainly with describing a speaker's knowledge of a language, or linguistic competence, rather than the actual use of language, or performance. However, performance represents our main source of data about competence. Since knowledge is not directly observable, the shape of generative grammars is guided largely by judgements that native speakers make about the acceptability of specific utterances. Acceptability is a matter of degree, not a yes/no proposition. Data about both acceptable and unacceptable utterances is necessary to construct grammars that describe just the utterances they are supposed to.

All generative theories of grammar assume that linguistic knowledge is best characterized as a finite set of basic elements and a finite set of principles for combining basic and complex elements. This view best describes how speakers can understand and

[1] Gazdar, et. al. 1985

create an unlimited number of utterances that they have never heard before. In speaking or understanding an utterance, a speaker makes use of structured mental knowledge, assigning a structure to the utterance (if possible) in terms of basic elements and combinatorial principles.

2.1 Inheritance hierarchies

One key assumption behind HPSG is that a grammar is best represented as a system of sort inheritance hierarchies. A sort inheritance hierarchy is way to classify objects in an efficient manner.

The Dewey Decimal system, or DDS, used to classify books by subject in many libraries, is an example of a simple sort inheritance hierarchy. Books are classified into 9 broad categories (as in fig. 2.1), and further sub-classified, as in fig. 2.2.

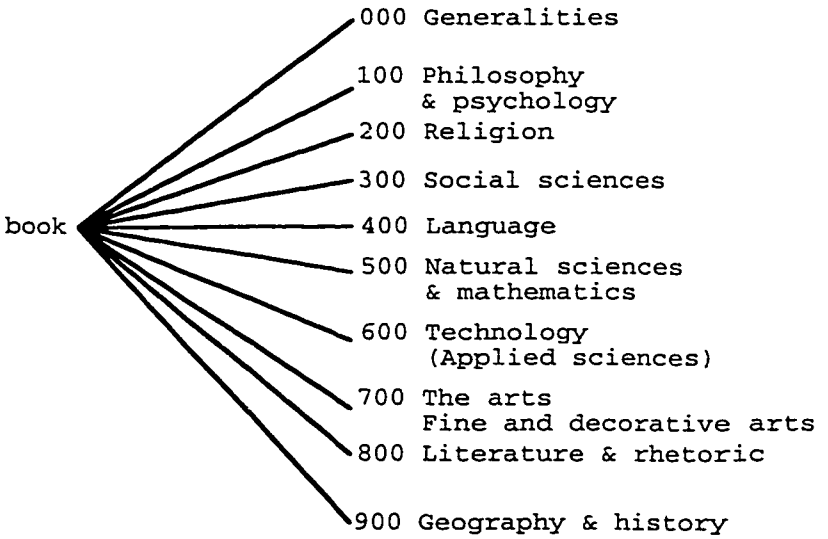

Fig. 2.1: The Dewey Decimal 100's

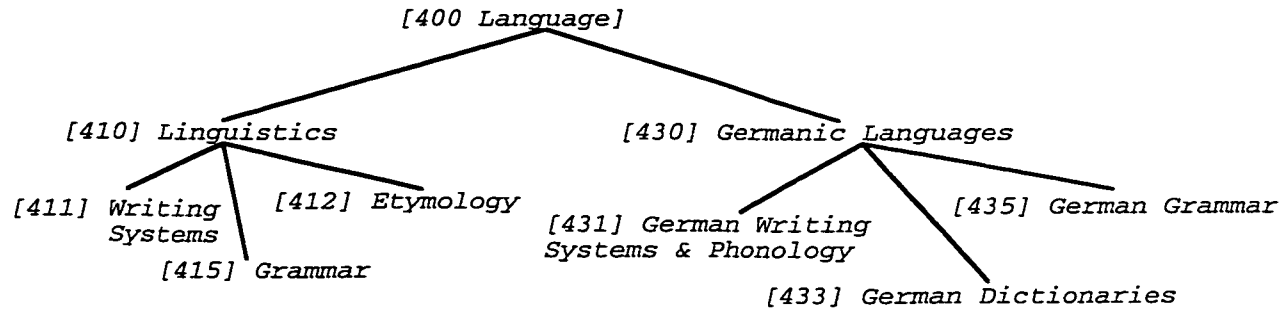

Fig. 2.2: Partial sort hierarchy for [400] Language

In each local tree, the daughter nodes inherit the properties of the mother node. For example, a [415] Grammar book is a [410] Linguistics book, and a [400] Language book. The first digit (4) is an attribute of a language book. The second digit (1) is an attribute of a linguistics book, a sub-sort of language book. The third digit (5) is an attribute of a grammar book, a sub-sort of linguistics book. In this way, books are organized by subject, going from general to specific. Librarians have to know the criteria for each sort to classify books properly.

While the Dewey Decimal System can be thought of as an inheritance hierarchy of book sorts, it is not a multiple inheritance hierarchy. A book can only inherit attributes going "up the chain", not from any other nodes in the tree.[2] In the end, there are a limited number of book types, leading to difficult classification problems. For example, how should one classify Philosophy of language by Alexander Miller (1998)? Assuming that the subject of the book deals with both philosophy and language, this title might deserve a classification both in [100] Philosophy and [400] Language. The DDS number for this

[2]There is a certain amount of cross-cutting regularity in the third-digit DDS tier. For example, a third digit classification of (1) in language classifications (as in 411 or 431) generally has to do with writing systems. However, this regularity is not consistent. Linguistics has a separate sub-sort for phonology (414), while Germanic languages puts phonology with writing systems (411).

book turns out to be 401 M612p, so Philosophy of language is considered a language book, according to the DDS. If the DDS were a multiple inheritance hierarchy of book sorts, it would be possible to for a particular book to inherit attributes from multiple nodes in the DDS hierarchy, thus instantiating the type language-philosophy-book. In this example, Philosophy of Language could inherit the attributes of [100] Philosophy and [400] Language.[3]

Fig. 2.3 below shows a very simple (partial) multiple inheritance hierarchy for sorts of verb. Two kinds of classification are at work here.

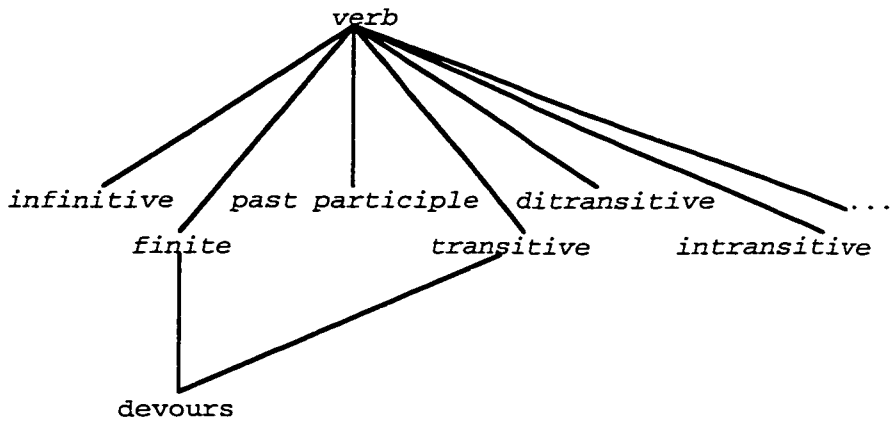

Fig. 2.3: Partial hierarchy of verb sorts

On the one hand, the hierarchy classifies verbs according to verb form (vform). Three vforms are listed: infinitive, finite, and past participle (not a complete listing). On the other hand, the hierarchy also classifies verbs according to the number of syntactic arguments they take. Intransitive verbs have a subject, transitive verbs have a subject and

[3]I do not suggest that call numbers for books be assigned according to a multiple inheritance hierarchy. The most important function of the DDS is to assign books a unique identifier (call number) so they can be located in the library. Assigning multiple call numbers to each title would undermine the book-finding function of the DDS.

object, and ditransitive verbs have 2 objects and a subject.

The verb devours is both a finite verb and a transitive verb, so it inherits whatever attributes are appropriate for finite verbs (such as specification for person and number) and whatever attributes are appropriate for transitive verbs (such as specification that the verb requires two syntactic arguments, a subject and a complement).

The efficiency of multiple inheritance hierarchies like fig. (2.3) lies in the fact that appropriate attributes for each sort can be stated just once in the hierarchy. In this example, the notion of "verb finiteness" is stated just once, and all finite verbs inherit their finite attributes from the sort finite_verb.

2.2 Sort declarations, inheritance, unification, feature structure descriptions

Thus far, sorts have been presented simply as objects with arbitrary labels. But a label does not characterize, for example, what the attributes of a finite verb are, nor do labels indicate what information is inherited from sort to sort. Nor is there any indication of any constraints on sort inheritance. Clearly, it would be contradictory for a verb sort to inherit from both finite_verb and infinitive, so inheritance must be constrained. Constraints on sort inheritance follows from the way sorts are defined. Sort definitions, usually called sort declarations, are expressed in a formal logic for linguistic representations (King 1989, Pollard 1998, Carpenter 1992). Formal logic formulas make for difficult reading, but fortunately an easy-to-read abbreviation system is available in the form of attribute-value matrices, or AVMs. Fig. 2.4 shows a generic sort declaration in AVM form.

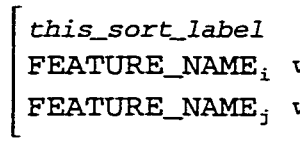

Fig. 2.4: Generic sort declaration

The label or sort name, here this_sort_label, is the top-most entry inside the brackets, written in italics. Sort labels are arbitrary names that serve to distinguish sorts.

Feature names and feature values represent the defining attributes of a sort. As a more concrete example, fig. 2.5 shows a very simple sort declaration for finite_verb. This sort declaration states that the sort finite_verb has three defining features and feature values. First, finite verbs have a feature VFORM that has the value finite. Secondly, finite verbs have a feature PERSON that has a person sort value. Thirdly, finite verbs have a feature NUMBER that has a number sort value.

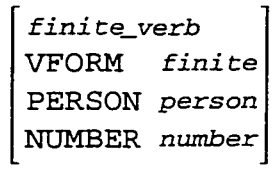

Fig. 2.5: sort declaration for finite_verb

The simplest possible sort has no features, having only a sort label. These sorts are called atomic sorts, because they have no internal structure. Sorts like +, finite, 3rd_person, singular are all atomic sorts.

In addition to complex or atomic sorts, the value of a feature can also be a set of feature structures, or a list of feature structures. A set is an unordered collection of objects, while a list is an ordered collection of objects. Curly brackets indicate sets, and angle brackets indicate lists, as in fig. 2.6 below.

$$\begin{bmatrix} \textit{sort\_label} \\ \text{LIST\_FEATURE} & \langle \text{obj}_1, \text{obj}_2, \ldots \text{obj}_n \rangle \\ \text{SET\_FEATURE} & \{ \text{obj}_i, \text{obj}_j, \ldots \text{obj}_k \} \end{bmatrix}$$

Fig. 2.6: List-valued and set-valued features

The "inheritance" in a multiple inheritance hierarchy of sorts is represented as a merging of features of 2 sorts to form a more specific sort that is consistent with both parents. This merging relation is called unification.[4] Fig. 2.7 below is an example of sort inheritance, where two sorts, finite_verb and transitive_verb unify to form a more specific sort called finite_trans_verb, which inherits all the features appropriate to both parents.

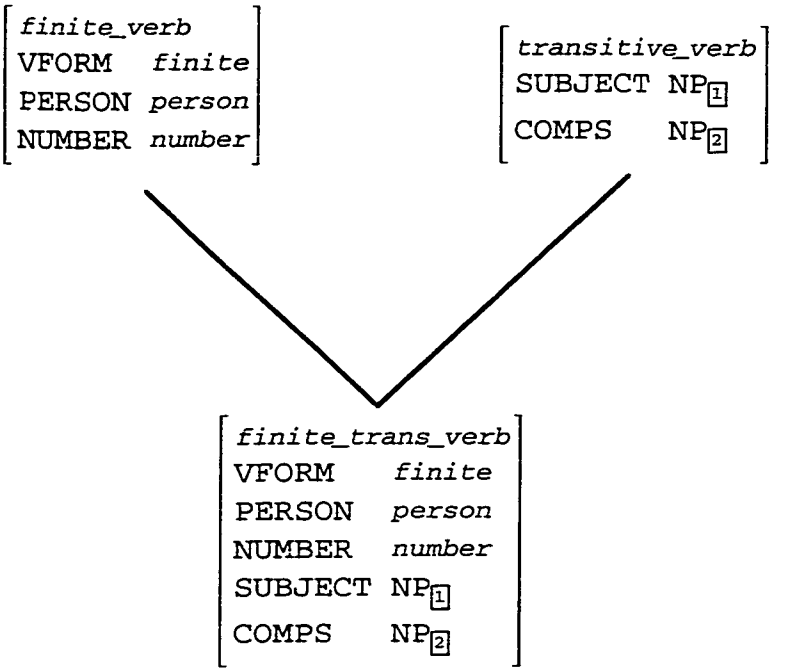

Fig. 2.7: finite_trans_verb inherits features from finite_verb and transitive_verb[5]

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[4]Unification is technically defined in terms of subsumption.

[5]Sort names are not generated, but rather arbitrarily assigned by linguists. Sort names play no role in unification. The unified sort *finite_trans_verb* could have been given any number of other names, like *trans_finite_verb*, *foo_verb*, *my_special_verb*, 1011001, etc.

Unification is not order-dependent, so if A and B are feature structures, then $A \cup B = B \cup A$. In typical cases where a sort inherits from more than two parent sorts, the order in which the parent sorts are unified is not significant. Because unification is not dependent on order, it allows HPSG to specify constraints (in the form of sorts) without having to specify the order that constraints are applied.

Sorts formed by unification are consistent with the parent sorts, meaning that feature names and feature values in the unified sort may not contradict feature names and values in either parent sort. In cases where 2 sorts have contradictory features or values, unification is undefined, and no feature inheritance is possible. For example, fig. 2.8 below shows two sorts whose unification is undefined because each sort defines a contradictory value for the feature VFORM. In this way, the nature of unification along with appropriate sort declarations constrains multiple inheritance in a sort hierarchy.

$$\begin{bmatrix} \textit{finite\_verb} \\ \text{VFORM} \quad \textit{finite} \\ \text{PERSON} \quad \textit{person} \\ \text{NUMBER} \quad \textit{number} \end{bmatrix} \quad \begin{bmatrix} \textit{infinitive\_verb} \\ \text{VFORM} \quad \textit{infinitive} \end{bmatrix}$$

Fig. 2.8: Unification is undefined because sorts have conflicting values for VFORM

The feature structure descriptions presented thus far represent statements about the properties appropriate to classes of linguistic objects. A generative grammar aims to make generalizations about the structure or behavior of a language, and feature structure descriptions represent these generalizations in HPSG.

It is important to distinguish between feature structure descriptions, which describe classes of linguistic objects (with some objects being abstract, theoretical objects), and fully-specified feature structures, which model linguistic expressions. To keep the

distinction between feature structures and feature structure descriptions clear, feature structures are represented as directed graphs (rather than as AVMs). Fig. 2.9 below (from Pollard & Sag 1994) shows a directed graph which models the English pronoun she. This thesis will not deal with fully specified feature structures.

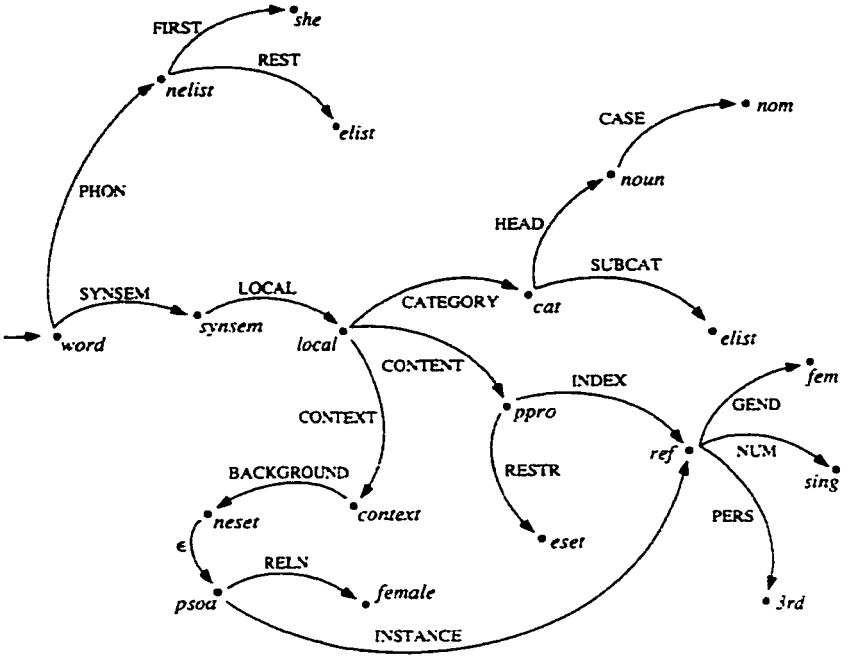

Fig. 2.9: Feature structure representing the English pronoun she, from Pollard & Sag 1994

2.3 The structure of *signs*

The sort sign is the feature structure that represents linguistic expressions in the most general way. Signs have 2 subsorts, word and phrase. Signs (both words and phrases) have phonological, syntactic, semantic, and contextual features. Fig. 2.10 below gives the sort declaration for sign. The feature PHON represents a sign's phonology. SYNSEM represents syntactic, semantic, and contextual properties, information that can be subcategorized for.[6]

[6]The occurrence of a sign in a particular context is often restricted to a certain semantic or syntactic class. This resticting is called *subcategorization*. For example, the verb *devours* requires (subcategorizes for) a

$$\begin{bmatrix} sign \\ \text{PHON } list\ (phonological\_string) \\ \text{SYNSEM } cannonical\_synsem \end{bmatrix}$$

Fig. 2.10: Sort declaration for *sign*

Fig. 2.11 shows a *sign* with the main features and values of a *cannonical_synsem* specified. A *cannonical_synsem* has the features LOCAL and NONLOCAL, a distinction important in the analysis of unbounded dependancy constructions (UDCs).[7] The value of the feature LOCAL is the *local* sort, which has 3 features, CATEGORY, CONTENT, and CONTEXT. The *category* sort represents information about a *sign's* syntactic category. The *content* sort represents information about a *sign's* semantic content. The CONTEXT feature represents contextual information.

3rd per. sing. noun phrase subject.

The PHON feature is distinct from SYNSEM because the phonology of a *sign* can not be subcategorized for.

[7]Unbounded dependency constructions are constructions where a syntactic dependent can occur arbitrarily far away from its head. One kind of UDC are *wh*-questions like *John wonders who Sandy loves* __. The gap, indicated by __, may occur arbirarily far away from the filler, *John*. See Pollard & Sag 1994 ch4 for a discussion of UDCs.

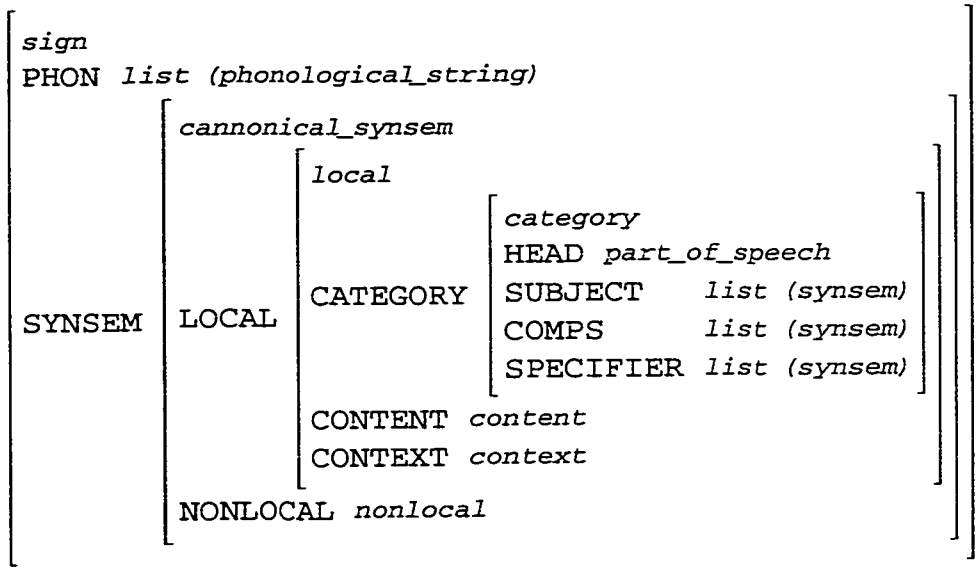

Fig. 2.11: *sign* with SYNSEM details

Within the *category* sort, the feature HEAD represents information appropiate to the *sign's* part of speech. The valence features SUBJECT, COMPS, SPECIFIER encode the *sign's* subcategorization requirements. For example, a verb might require a subject along with a number of complements, while a noun might require a specifier, such as a definite article, or a complement.

The sort declaration for *word*, a subsort of *sign*, is given in fig. 2.12 below. In addition to the *sign* features discussed earlier, *words* have a feature MORPH that represents information about morphological structure (see Riehemann 1993, 1998). In addition, the value of the CATEGORY feature is a subsort of *category* that includes the ARG-ST feature, a list-valued concatenation of the SUBJECT, SPR, and COMPS lists representing information about the word's argument structure.[8] The ARG-ST feature plays an important role in the

[8] *Valence* and *argument structure* are related, but distinct notions. Valence refers to the subcategorization requirements of a word or phrase, while argument structure is a lexical property of words only. For example, the valence of the phrase **devours apples* indicates that this verb phrase requires just a subject to be acceptable (as it already has an object). The ARG-ST of *devours* indicates that this verb requires 2 arguments

HPSG analysis of binding relations.[9]

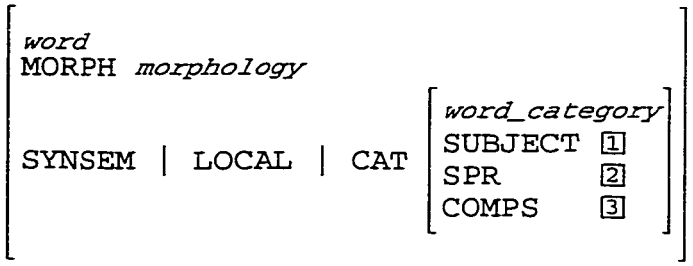

Fig. 2.12: sort declaration for *word*

Sets of boxed integers like '1 ', called *tags*, indicate structure-sharing. Structure-sharing allows a single feature structure to be the value of multiple features. Tags with matching integers stand for the same[10] feature structure in an AVM. For example, the matching 1 tags in fig. 2.12 indicate that the same structure must appear in place of each tag. Combined with the list-append function (represented by the 'o ' symbol), the constraint in fig. 2.12 states that the value of ARG-ST is the list-append of the SUBJECT, SPR, and COMPS lists. Structure-sharing plays a crucial role in several common HPSG constraints.

2.4 The structure of phrases

The other subsort of *sign* is phrase. Loosely speaking, phrases are complex structures composed of words and phrases. Within the field of syntax, linguists often use tree

(the devouring and devoured entities). ARG-ST does not track the actual occurence of syntactic arguments. A word's argument structure is usually the list-append of the subject, specifier, and comps lists (the valence lists).

[9]Binding is concerned with determining constraints on the co-indexing of noun phrases in sentences. For example, in *John hurt himself, John* and *himself* must be the same person, they must be coindexed. In *John hurt him, John* and *him* may not be coindexed.

[10]Here, the same means token-identity, literally the exact same object.

diagrams to represent phrase structure. For example, fig. 2.13 below shows a tree diagram for the sentence *Hans gab mir das Buch* 'Hans gave me the book'. The sentence (S) is divided into a subject NP (Hans) and a verb phrase (VP). The VP, in turn, consists of three signs, *gab*, *mir*, *das Buch*.

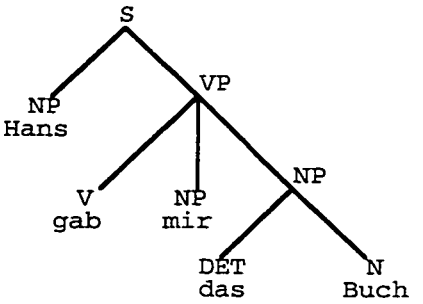

Fig. 2.13: tree diagram showing the structure of *Hans gab mir das Buch*

Trees are convenient, familar representations of phrases, but have no formal status in HPSG, as phrase structure is formally represented using feature structures. For example, the verb phrase (VP) in fig. 2.13 is an instance of a specific phrase type, the *head-comp-ph*, represented with an AVM in fig. 2.14.

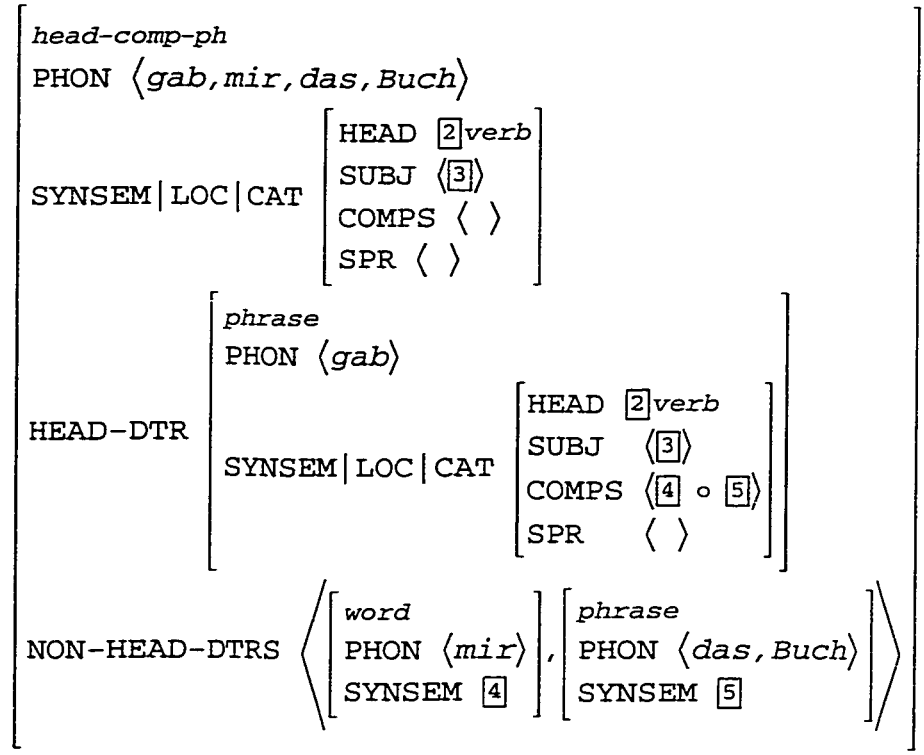

Fig. 2.14: (partial) feature structure of *head-subj-ph* in *Hans gab mir das Buch*

Representation of phrase structure follows the phrase-type analysis of Sag (1997). The phrase represented in fig. 2.14 is a verb phrase that has three daughters, a head daughter and two non-head daughters. The head daughter *gab* 'gave' is a verbal word. The tags "2 " indicate that the VP and its head daughter share the same head values -- both are verbal, both share the same verb form (*finite, infinitive*, etc). This structure-sharing of head values is the defining characteristic of headed phrases. The tags "3 " indicate that the value of SUBJ in the head daughter is shared with the SUBJ value of the phrase, representing the fact that the verb phrase requires a subject. The "4 " and "5 " tags indicate that the value of COMPS in the head daughter is the list-append of the SYNSEM values of the non-head

daughters, indicating that the non-head daughters are the complements of the head daughter. The mother phrase has an empty comps value, indicating that subcategorization requirements for complements have been fulfilled.

Three important headed phrase types are listed below:

head-subj-ph a head (typically a verb phrase) occurs with a subject word or phrase. The SUBJ value of the head daughter is shared with the SYNSEM of the non-head (subject) daughter. This phrase type is fully saturated, meaning it has empty values for *subj*, *comps*, and *spr*. Clauses are head-subj phrases.

head-comp-ph a head occurs with one or more complements. The head is a word. The COMPS value of the head is a list of SYNSEMs consisting of the SYNSEMs of the non-head (complement) daughters. The head-comp phrase has an empty comps value. Verbs, nouns, or prepositions may head this kind of phrase.

head-adjunct-ph a head occurs with an adjunct sister. Adjuncts do not appear on the head's valence (SUBJ, COMPS, SPR) lists. Instead, the adjunct's MOD value is shared with the SYNSEM value of the head. Adjective-noun combinations and verb-adverb combinations are head-adjunct phrases.

HPSG phrase structure, as set forth in Pollard & Sag (1994) and Sag (1997) is primarily concerned with headed phrases, where a single distinguished daughter, the head, determines (shares) the head value of the phrase.

However, the theory allows for other possibilities as well. One might imagine a phrase where each daughter contributes something to the head value of the phrase, a multi-headed phrase, similar to the multi-headed analysis for coordinate structures proposed by Gazdar, et. al. (Gazdar 1985). A multi-headed phrase type is a plausible

analysis for path expressions in sentences like (2.1a-b). In (2.1a), given the assumption that the path expression *aus dem Haus in die Straße* is a phrase consisting of two prepositional phrases, it is not obvious which daughter might be the head, nor is it obvious what the head value of the phrase ought to be. In a multi-headed analysis, each daughter would be a head, and the head value of the phrase would be a function of the daughter's head values.

(2.1a) Hans lief aus dem Haus in die Straße
Hans ran out the house in the street
Hans ran out of the house into the street

(2.1b) Hans lief aus dem Haus hinaus
Hans ran out the house out
Hans ran out of the house

In order to take into account the possiblility of multi-headed phrases, one might want to define the sort *phrase* as in fig. 2.15, with a feature HEAD-DTRS that takes a list of *signs* as its value. Single-headed phrases (fig. 2.16) have singleton list values for HEAD-DTRS, and phrases with non-head daughters (*val-ph,* fig. 2.17) have a NON-HEAD-DTRS feature whose value is a list of phrases. The value of HEAD-DTRS for multi-headed phrases (fig. 2.18) is limited to non-empty, non-singleton lists.

$$\begin{bmatrix} \textit{phrase} \\ \text{HEAD-DTRS } \textit{list (signs)} \end{bmatrix}$$

Fig. 2.15: sort declaration for phrase

$$\begin{bmatrix} \textit{sg-hd-ph} \\ \text{HEAD-DTRS } \langle [\ ] \rangle \end{bmatrix}$$

Fig. 2.16: sort declaration for *sg-hd-ph*, a subsort of *phrase*

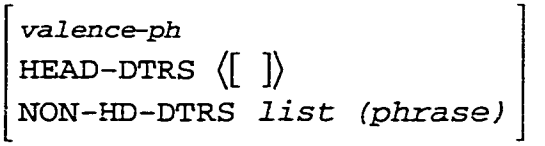

Fig. 2.17: partial[11] sort declaration for *val-ph*, a subsort of *sg-hd-ph*

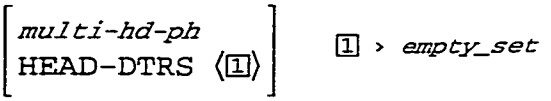

Fig. 2.18: partial sort declaration for *multi-hd-ph*

2.5 Semantics

A sign's CONTENT value represents its semantics. Following Wasow & Sag (1998) and Copestake, et.al. (1997), CONTENT values take the form shown in fig. 2.19.

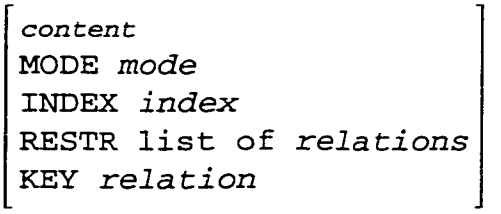

Fig. 2.19: sort declaration for CONTENT

According to Sag & Wasow, the four subsorts of *mode* are the atomic sorts *proposition*, *question*, *directive*, and *reference*. Each semantic mode represents a basic kind of meaning. For example, sentences like *Kim is running* express propositions, while sentences like *Is Kim running?* express questions. The command *run!* is a directive. Noun phrases like *Jim* or *the weather in Illinois* are referential.

The two subsorts of *index* are *indiv_index* and *sit_index*. An *index* is similar to a variable corresponding to the individual or situation that a sign refers to. Signs that have

[11]Not shown are constraints related to HEAD feature sharing, semantic composition, or valence list values.

the same INDEX value refer to the same situation or individual. For example, in the expression *Kim hurt himself*, The signs *Kim* and *himself* must refer to the same individual, so they have the same INDEX value, and are said to be coindexed.

The restriction (RESTR) list specifies the conditions that must be satisfied in order for the expression to be true.[12] Each condition in the list is represented by a relation (rel). Relations come in a wide variety of forms representing the ways that linguistic signs specify properties of and relations between individuals and situations.

The KEY value represents information relevant to semantic selection, and will be discussed in more detail in section 2.8, *Semantic Selection.*

2.6 Semantic relations

Following Davis (1996), verb relations have features like ACT (actor), UND (undergoer). Lexical entailments determine what roles are appropriate for a given relation. For example, volitional involvement and sentience are characteristic of actors. Undergoing a change of state, or being causally affected are characteristic entailments of undergoers. Fig. 2.20-2.21 show relations for the verbs *laugh* (2.20) and *love* (2.21).

---

[12]The notion of an expression "being true" varies according to semantic mode. For example, a proposition is true if a situation exists metting all the conditions of the RESTR list. A directive is true if the directive is acted on in a way consistent with the RESTR list.

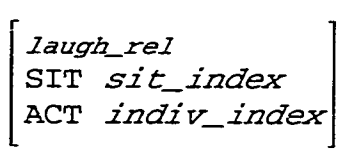

Fig. 2.20: the *laugh* relation

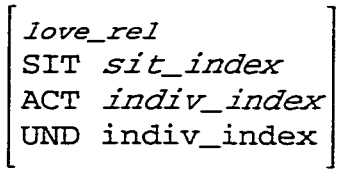

Fig. 2.21: the *love* relation

The values of ACT and UND are *indiv_index*, corresponding to the individuals who are the actors or undergoers in each relation. For example, in the expression *Kim loves Sandy*, *Kim* is the actor, and *Sandy* is the undergoer. The value of SIT is a situation index corresponding the situation being referred to.

To simplify semantic composition, Davis' complex verb relations consisting of relations embedded within relations will be simplified to single relation. For example, Davis' proposal for caused-motion relations like *throw*, shown in fig. 2.22, will be simplified as in fig. 2.23.

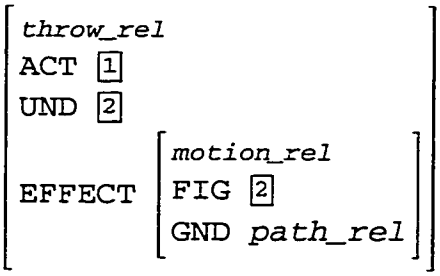

Fig. 2.22: Davis-style representation of *throw_rel*

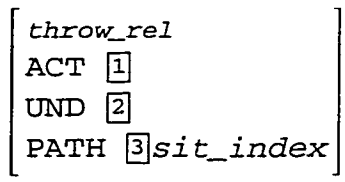

Fig. 2.23: simplified representation

The value of PATH is a situation index referring to a stretch of space traversed by the moving entity. Chapter 5 provides a more detailed definition of the value for PATH.

2.7 Semantic composition

The CONTENT value of a headed phrase is systematically related to the CONTENT values of its daughters. The semantic composition principles of HPSG specify the relation

of phrasal CONTENT to daughter CONTENT. Figure (2.24-2.26) show the CONTENT values of the signs *Kim* and *laughs*, and the CONTENT of the phrase *Kim laughs*. Figure (2.26) shows that the values of MODE, INDEX, and KEY for a phrase are shared with its head daughter. The RESTR value of a phrase is the collection of the daughter RESTR values.

$$\begin{bmatrix} \textit{content} \\ \text{MODE } \textit{referential} \\ \text{INDEX } \boxed{1} \\ \text{RESTR } \left\langle \boxed{3} \begin{bmatrix} \textit{called\_rel} \\ \text{SIT } \boxed{2} \\ \text{INSTANCE } \boxed{1} \\ \text{NAME } \textit{kim} \end{bmatrix} \right\rangle \\ \text{KEY } \boxed{3} \end{bmatrix}$$

Fig. 2.24: CONTENT of *Kim*

$$\begin{bmatrix} \textit{content} \\ \text{MODE } \boxed{6}\textit{propositional} \\ \text{INDEX } \boxed{4} \\ \text{RESTR } \left\langle \boxed{5} \begin{bmatrix} \textit{laugh\_rel} \\ \text{SIT } \boxed{4} \\ \text{ACT } \boxed{1} \end{bmatrix} \right\rangle \\ \text{KEY } \boxed{5} \end{bmatrix}$$

Fig. 2.25: CONTENT of *laughs*

$$\begin{bmatrix} \textit{content} \\ \text{MODE } \boxed{6} \\ \text{INDEX } \boxed{4} \\ \text{RESTR } \langle \boxed{3} + \boxed{5} \rangle \\ \text{KEY } \boxed{5} \end{bmatrix}$$

Fig. 2.26: CONTENT of phrase *Kim laughs*

2.8 Semantic selection

Signs commonly exploit semantic criteria to select compatible sisters. For example, as shown by sentences (2.2a-c), the verb *lay* occurs with some prepositions, but not others, to indicate the where the book goes.

(2.2a) Kim put the book on the table
(2.2b) *Kim put the book to the table
(2.2c) *Kim put the book at the table

Following Copestake, et.al (1997), a sign's KEY value represents information relevant to semantic selection. For a *phrase*, the KEY value is shared with the KEY value of the head daughter. For a *word*, the KEY value is shared with a relation of the word's RESTR list. Semantic selection then amounts to specifying KEY values. For example, for an expression like *Kim laid the book on the table*, they KEY value of the prepositional phrase *on the table* is the relation on the RESTR list of the preposition *on*. The verb *laid* specifies that the KEY value of its complement PP be of an appropriate type which includes the *on_rel*, but excludes the *to_rel* and the *at_rel*.[13]

[13]Details of the selectional criteria for German verbs of placement like *stellen* 'put', *legen* 'lay" are found in Ch. 5.

Chapter 3: Path Particles

3.0: What are path particles?

In this thesis, the term *path particle* refers to the class of words that denote a path relation of one sort or another, but do not govern NP complements, thus excluding prepositions. In German, path particles and path prepositions together represent the primary means for expressing path relations.

Following Jackendoff (1990), path particles relate a moving figure to a curve in space traversed by the moving figure. Path relations are indeterminate in that they constrain the path of motion, but do not specify the path exactly. Thus, in sentences like (3.1a), the prepositional phrase *nach Berlin* 'to Berlin' entails that the path ends at Berlin, but leaves the exact route to the destination otherwise unspecified. Of course, additional expressions can be added, as in (3.1b), resulting in a more specified, but still indeterminate path.

(3.1a) Hans fuhr heute nach Berlin
Hans drove today to Berlin.
Hans drove to Berlin today

(3.1b) Hans fuhr heute von München nach Berlin
Hans drove today from Munich to Berlin
Hans drove from Munich to Berlin today

The definition offered above excludes certain sorts of directed activities that do not involve literal motion, activities like *starren* 'stare', *blicken* 'look', *rufen* 'call, yell', *sprechen* 'speak'. Sentences (2a-d) give examples of paths occurring with these verbs. I assume that an account of path relations for motion verbs will be relevant to these cases as well, but determining the relationship between directed activities and motion relations is

beyond the scope of this thesis.

(3.2a) Der Beamte starrte Hans an
The official stared Hans at
The official stared at Hans

(3.2b) Hans blickte auf den Hof hinaus
Hans looked on the courtyard out
Hans looked out on the courtyard

(3.2c) Hans rief Maria zu
Hans called Maria to
Hans called to Maria

(3.2d) Hans sprach mir zu
Hans spoke me to
Hans spoke to me

The class of path particles encompasses a variety of words often classified variously as adverbs or verb particles. For example, in (3.3) below, *ein* 'in' is usually called a verb particle, while *links* 'left' is usually called an adverb.

(3.3) Biegen Sie an der nächsten Ecke links ein!
curve you at the next corner left in!
Turn in left at the next corner!

It is sometimes claimed (Olsen 1997, Piñon 1992) that verb particles like *ein* are to be distinguished from other words because they are sublexical elements of some sort, so that the combination of a verb with a particle is a single word whose structure is still transparent to word order principles. In the sections that follow, I will show that particle verb constructions are licensed by principles of phrase formation (the Separate Words hypothesis), rather than word formation (the Morphological hypothesis). I will also argue that all words of the path particle class ought to be considered the same part of speech, as it is difficult to identify a property or properties that distinguish words like *ein* from

words like *links*.

Section 3.1 examines the assumptions made concerning the distinction between word formation and phrase formation. In particular, it is assumed that a distinction should be made between phrases and words, and that phrasal construction types should not be sensitive to word-internal structure. Section 3.2 shows that the Separate Words hypothesis correctly predicts the distribution and position of the *ge-* prefix in past participles, but the Morphological hypothesis does not. Section 3.3 makes the same argument concerning the position of the *zu* infinitival marker. Section 3.4 argues that the difference in sentence stress patterns between path particle verb constructions and prefixed verbs is correctly predicted by the Separate Words hypothesis. Section 3.5 argues that the phonological integrity of path particle verb constructions does not play a decisive role in determining whether an element is a word or a sublexical unit. Section 3.6 discusses cases where the path particle itself takes a modifier. Section 3.7 explains why conventionality and productivity have no role in determining whether an element is a word or a sublexical unit. Section 3.8 looks at the productivity of particle verbs in word formation, and argues that an element need not be a sublexical unit to be productive in word formation. Section 3.9 looks at the effects that particles have on a verb's argument structure, and argues that variation in verb argument structure can be explained if verbs subcategorize for particles. Section 3.10 looks at the claim that inflexible word order is a property of sublexical elements. Section 3.11 examines the separability of path particles from verbs, a fact not predicted by the Morphological hypothesis. Section 3.12 explains what part of speech path particles are. Section 3.13 provides a list of all path particles in German.

3.1 Word structure vs. syntactic structure

The distinction between word and phrase is meaningful because the principles of word formation differ significantly from the principles of phrase formation, justifying the traditional distinction between morphology and syntax Anderson (1992). In this thesis, it is assumed that syntactic selection is not sensitive to internal structure of words. This assumption is called the Lexicalist Hypothesis. In HPSG, the lexicalist hypothesis is represented by the separation of a word's morphological information (word-internal structure) from the information available for syntactic selection. In the representation of an HPSG *word* below, the feature SYNSEM "syntax-semantics" bundles information available for syntactic selection, while the MORPH feature represents word-internal structure. This division between SYNSEM and MORPH correctly predicts that verbs do not select a syntactic dependent with a certain prefix or stem. For example, we do not find examples of verbs that specify that its complement must begin with the prefix *ge-*.

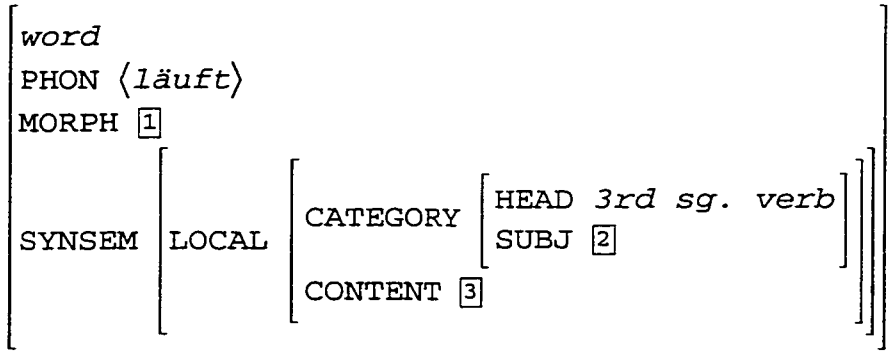

Fig. 3.1: Division of morphological and syntactic/semantic properties

3.2 The *ge-* prefix in past participles

The *ge-* prefix occurs in many, but not all past participle verb forms. For example, the past participle of the verb *fahren* 'drive' is *gefahren* 'driven', but the past participle of the

verb *transportieren* 'transport' is *transportiert* 'transported'. The occurrence of *ge-*in past participles is sensitive to the stress pattern of the verb. Verbs whose base forms carry primary stress on the initial syllable will take *ge-* in their past participle forms.

In the case of particle constructions, the *ge-* prefix occurs between the particle and the verb. For example, the past participle of the particle construction *ab•fahren* 'drive off' is *ab•gefahren*. The distribution of *ge-* in a particle construction is solely determined by the stress pattern of the verb. The presence or absence of a particle is not relevant to the occurrence of *ge-* in past participles.

The distribution and position for *ge-* follows directly from the claim that particles are words, not morphological elements. The *ge-* prefix occurs to the left of the verb because derivation of the past participle involves the verb itself, not words which occur with the verb. It also follows that the distribution of *ge-* is not sensitive to the occurrence of the particle, since the stress pattern of the verb itself is determinate, not the stress pattern of other words which occur with the verb.

The lists of verb forms in (5a-d) show the distribution and position of the *ge-* past participle prefix. Accent marks indicate word stress. Particles are separated from baseforms and past participles with a bullet. The list in (3.5a) shows that when word stress falls on the initial syllable, the past particle form of the verb must be derived using the *ge-* prefix. The list in (3.5b) shows that when word stress does not fall on the initial syllable, the past participle form of the verb may not be derived using the *ge-* prefix. The lists in (5c-d) below show that the presence of a particle with the verb is not a factor in the distribution of the *ge-* prefix. The verbs in (3.5c) occur with particles, and carry stress on the initial syllable of the verb stem like the verbs in (3.5a), and exhibit the same distribution for the

ge- prefix found in (3.5a). The verbs in (3.5d) also occur with particles, but do not carry stress on the initial syllable of the verb stem like the verbs in (3.5b), and exhibit the same distribution for the *ge-* prefix found in (3.5b).

(3.4a) **Stress falls on initial syllable of verb stem**

base form	past participle
fáhren 'drive'	gefáhren 'drove"
máchen 'make'	gemácht 'made'
lángweilen 'bore'	gelángweilt 'bored'
	*fáhren
	*mácht
	*lángweilt

(3.4b) **Stress falls on non-initial syllable of verb stem**

transportíeren 'transport'	transportíert 'transported'
riskíeren 'risk'	riskíert 'risked'
volléndеn 'complete'	volléndet 'completed'
verfáhren 'proceed'	verfáhren 'proceeded'
	*getransportíert
	*geriskíert
	*gevolléndet
	*geverfáhren

(3.4c) **Stress falls on initial syllable of the verb stem in particle construction**

base form	past participle
áb•fáhren 'drive off'	áb•gefáhren 'drove off'
hinéin•spríngen 'jump in'	hinéin•gesprúngen 'jumped in'
	*geáb•fáhren
	*áb•fáhren
	*gehinéin•sprúngen
	*hinéin•sprúngen

(3.4d) **Stress falls on non-initial syllable of the verb stem in particle construction**

áb•transportíeren 'transport off, away'	áb•transportíert 'transported'
án•vertráuen 'entrust to'	án•vertráut 'entrusted to'
	*geáb•transportíert
	*áb•getransportíert
	*geán•vertráut
	*án•gevertráut

A phrasal account of particle constructions correctly predicts that the *ge-* prefix will occur between the particle and the verb, because past participle forms are derived from baseform verb stems, independent of any other words which may occur with the verb. Thus, forms like **geab•fahren* and **geein•studiert* are not well-formed because the *ge-* prefix attaches to stems, not phrases. An account where particle constructions are licensed by principles of word formation must treat these constructions as exceptional. In this view, the *ge-* prefix occurs first in all initially stressed verbs except for particle constructions, where the *ge-* prefix occurs between the particle and the rest of the verb.

A phrasal account also correctly predicts that the stress pattern of the verb itself determines the distribution of *ge-* in past participles, without regard to the stress pattern of the particle. The word formation rules that relate baseforms to past participles must take into account the stress pattern of the baseform, but can not take into account the stress pattern of any words that might occur with the verb. Thus, *ge-* occurs in forms like *ab•gefahren* and *hinein•gesprungen* because the baseforms *fahren* and *springen* carry initial stress, but not in forms like *ab•transportiert* or *an•vertraut*, because the baseforms *transportieren* and *vertrauen* do not carry initial stress.

A single-word account requires a more complex analysis that treats particle constructions as exceptional. In this analysis, word formation rules relating past participles

to baseforms must have access to the internal structure of the particle construction. These rules must be able to determine the subpart of the word whose stress pattern determines the distribution of *ge-*. For all other verbs, the stress pattern of the whole word determines whether *ge-* occurs or not. Therefore, in this view, particle constructions represent an exception to an otherwise general account of the distribution of *ge-*.

3.3 The infinitive marker *zu*

The infinitive marker *zu* occurs to the left of baseform verbs in infinitive forms, much like *to* in English infinitives. German differs from English in that split infinitives do not occur. In sentence (3.5) below, *zu laufen* is the infinitive. Sentence (3.6) shows that syntactic material does not split *zu* from the baseform verb.

(3.5) Peter versuchte, schnell ins Haus zu laufen
Peter tried quickly into the house to run
Peter tried to quickly run into the house

(3.6) *Peter versuchte, ins Haus zu schnell laufen
Peter tried into the house to quickly run

I leave open the question whether German infinitival constructions like *zu laufen* are best analyzed as phrases or single words.

The distribution of *zu* is not sensitive to the morphological or phonological structure of the verb, so that *zu* occurs to the left of any baseform verb to form an infinitive. However, in the case of particle constructions, *zu* occurs between the particle and the verb. The examples in (3.7) below show infinitives for simple verbs, compound verbs, verbs with prefixes, and particle constructions.

(3.7)

simple verb:	*zu fahren* 'to drive'
compound:	*zu langweilen* 'to bore'
prefixed verb:	*zu verfahren* 'to proceed'
	**verzufahren*
particle:	*abzufahren*
	**zu abfahren*

The position of *zu* in particle constructions follows from the claim that the particle constructions are phrasal. Since *ab* in constructions like *ab•fahren* 'drive off' is a word which occurs with the verb, the phrasal hypothesis predicts that *ab* will not occur between *zu* and the baseform verb.

An analysis that claims particle constructions are single words requires a more complicated account of the position of *zu*. In this account, *zu* occurs between sublexical elements, so word formation rules presumably determine the form of these infinitives. Only in the case of particle constructions would these rules have access to the internal structure of the baseform; for other verbs, *zu* is prefixed to the baseform. Thus, particle constructions would represent an exception to an otherwise general account of the position of *zu* in infinitives.

3.4 Sentence stress patterns in particle constructions

Sentences exhaustively consist of one or more stress groups. The distribution of stress groups is related to the syntactic structure of the sentence, without reference to the internal morphological or phonological structure of individual words. The element in each stress group that carries the heaviest stress bears syntactic stress. Syntactic stress is realized in a stress group by intensifying the lexical word stress of one of the words in the stress group.

The distribution of syntactic stress in particle verb constructions is consistent with a

phrasal analysis of these constructions. Particles bear syntactic stress. In the sentence groups below, syntactic stress patterns in particle verb constructions are compared to syntactic stress patterns in other types of sentences. In each case, syntactic stress patterns in sentences with the particle verb construction *an•kommen* 'arrive' are the same as sentences where the particle is replaced by the adverb *spät* 'late'. Syntactic stress is marked with a ° symbol. Particles are separated from verbs with a • symbol. The following sentences are assumed to be neutral utterances, where no reference is made to previously mentioned material and no emphasis is intended.

(3.8a) Hans kam heute °spät
Hans came today late
Hans came late today

(3.8b) Hans kam heute °an
Hans came today on
Hans arrived today

(3.8c) Die Stadt verkam °völlig
the city became run-down completely
The city became completely run-down

(3.9a) Hans ist heute °spät gekommen
Hans is today late come
Hans has come late today

(3.9b) Hans ist heute °an•gekommen
Hans is today on-come
Hans has arrived today

(3.9c) Die Stadt ist °völlig verkommen
the city is fully run-down
The city has become completely run-down

(3.10a) ...wenn Hans heute °spät gekommen ist
...if Hans today late come is
...if Hans has come late today

(3.10b) ...wenn Hans heute °an•gekommen ist
...if Hans today on-come is
...if Hans has arrived today

(3.10c) ...wenn die Stadt °völlig verkommen ist
...if the city completely run-down is
...if the city has become completely run-down

Sentences (3.8a-3.10c) show that the distribution of syntactic stress in sentences with particle verb constructions is the same as sentences with adverbs, and different from sentences with prefixed verbs. This is to be expected if particle verb constructions are phrasal. Because the particle is an independent word, it is potentially eligible to bear syntactic stress. In sentences like (3.9a-3.10c), the word immediately preceding the past participle bears syntactic stress, even if the preceding word is a particle.

In a single-word analysis of particle verb constructions, the rules which govern the placement of syntactic stress must distinguish between compound verbs and prefixed verbs on the one hand, and particle verbs on the other. In this analysis, particle verbs represent an exception to an otherwise general account of syntactic stress in the sentences above.

3.5 The pronunciation of particle verb constructions

Some German speakers differentiate particle verb constructions from other verb constructions in their pronunciation. Moulton (1962) claims that word stress of the verb in certain particle verb constructions is weaker than the word stress in similar constructions with adjuncts or complements. In addition, it is claimed that the transition time between the particle and verb is shorter than the transition time between an adjunct or a complement and the verb. Moulton gives the following examples. In sentences (3.11a-3.11b) below, the adjunct-head-phrase *frei halten* 'hold freely' is compared to the particle verb construction *frei•halten* 'keep free'. In sentences (3.12a-3.12b) below, the comp-head-phrase *sitzen bleiben* 'remain seated' is contrasted with the particle construction

sitzen•bleiben 'repeat the grade in school':

(3.11a) er wird die Rede °'frei 'halten
he will the talk freely hold
he will hold the talk freely (without notes)

(3.11b) er wird seine Freunde °'frei "halten
he will his friends free-hold
he will treat his friends (foot the bill)

(3.12a) er muß °'sitzen 'bleiben
he must sit remain
he must remain seated

(3.12b) er muß °'sitzen "bleiben
he must sit remain
he must repeat the grade

In an informal survey of several native German speakers, the distinction in stress in sentence pairs like (3.11a-3.11b) above was not consistently apparent, but several speakers pronounced the non-particle verb sentences (3.11a) and (3.12a) more distinctly, with a greater transition time than in particle verb constructions. A more formal study (beyond the scope of this thesis) would be required to develop real data.

A short transition time between elements could provide evidence that the particle and the verb form a phonological unit of some sort. However, this does not preclude the possibility that these elements form a phrase. The transition time between elements is not relevant to the word/morpheme distinction. For example, the clitic *-s* in sentences like *wie geht's?* 'how's it going?' is a reduced form of the pronoun *es* 'it', and forms a phonological unit with the preceding verb, but there is no reason to assume that the phrase structure of the sentence differs from the version where the full form of the pronoun occurs, *wie geht es?*. In fact, Anderson (1992) suggests that German particles are simple clitics of some sort,

full-fledged words with a strong phonological attachment to other words.[1]

3.6 Path Particles can be independently modified

The semantic composition for certain path particle constructions suggests that the particle itself can be modified independently of the verb.[2] For example, the most straightforward semantic composition of sentence (3.14a) is *lief* [*direkt hinein*], so that *direkt* modifies *hinein*. Sentence (3.14b) shows that *direkt* by itself cannot modify the verb *lief*.

(3.13a) Peter lief direkt hinein
Peter ran directly in
Peter ran directly in

(3.13b) *Peter lief direkt
Peter ran directly

That modifiers and particles form phrases with eachother is reflected in the syntax as well. Wherever the particle occurs in the sentence, the modifier occurs to the immediate left of the particle. For example, the particle and its modifier are fronted as a unit. Sentences (3.14a-3.14c) below show that while the particle phrase can be fronted, neither the particle nor the modifier can be fronted individually without the other.

[1]Anderson (1992) defines a simple clitic as "a lexical item whose phonological form does not include assignment to a prosodic unit at the level of 'word' (or some other appropriate unit that consititutes an essential domain of stress assignment)." An analysis where path particles are simple clitics incorrectly predicts that particles are not eligible to bear syntactic stress. See section 3.?.

[2]Abraham (1990) provides examples of particle modification for non-path particle combinations like the resulative *leer trinken* 'drink empty'.

Sentences (3.15a-3.15c) show that some unmodified particles can be fronted, and that verb adjuncts which modify particle verb constructions can also be fronted:

(3.14a) Direkt hinaus lief Peter
Directly out ran Peter
Directly out ran Peter

(3.14b) ?Direkt lief Peter hinaus
?directly ran Peter out

(3.14c) *Hinaus lief Peter direkt
*out ran Peter directly

(3.15a) Hinaus lief Peter
out ran Peter
out ran Peter

(3.15b) Peter lief schnell hinaus
Peter ran quickly out
Peter ran out quickly

(3.15c) Schnell lief Peter hinaus
quickly ran Peter out
quickly, Peter ran out

Not all path particles can be independently modified. Some path particles that combine with verbs to form idiosyncratic meanings do not take independent modification. For example, one version of the combination *ein•fahren* 'drive in', in addition to the expected entailments of driving in to something, carries the additional entailment that the vehicle has arrived at an intended destination. Sentence (3.16a) below gives a typical example for this combination. Sentence (3.16b) shows that the particle *ein* cannot be independently modified by *direkt*.

(3.16a) Der Zug fuhr pünktlich ein
the train drove punctually in
The train pulled in on time

(3.16b) *Der Zug fuhr direkt ein
the train drove directly in
The train pulled directly in

This restriction on modification in less compositional combinations is similar to the restrictions found in idioms.[3] Components of idioms like *ins Gras beißen* 'die, lit. bite into the grass' are also not susceptible to independent modification. Sentence (3.17a) below shows a typical example for the non-compositional phrase *ins Gras beißen.* (3.17b) shows that the idiomatic meaning 'die' cannot be preserved if the noun *Gras* is modified.

(3.17a) Hans hatte keine Lust, ins Gras zu beißen.
Hans had no desire, in-the grass to bite
Hans had no desire to die.

(3.17b) Hans hatte keine Lust, ins hohe Gras zu beißen.
Hans had no desire, in-the tall grass to bite
Hans had no desire to bite into the tall grass

The fact that path particles can be modified independently of the verb, and the fact that linear precedence rules treat modifiers and particles treated as units both provide strong evidence that these path particle constructions are phrasal. The fact that some path particles cannot be independently modified is evidence that they combine with the verb in a idiosyncratic manner.

An account which views the particle and verb as a single word faces a more complex analysis in order to compose the correct semantic content for expressions with modified path particles. One solution would be to allow semantic principles in the syntax access to the internal semantic structure of particle verb constructions. However, this would violate the Lexicalist Hypothesis and is not generally motivated for other words in German.

[3]see Kren and Erbach, 1994.

Another solution would be to treat the verb, the particle, and the modifier as a larger (different) single word. This analysis is not supported by the syntactic behavior of modified prefixes, which treats the particle and the modifier as a unit independent of the verb.

3.7 Conventionality is irrelevant to the word/morpheme distinction

In many cases, the meaning of a particular particle verb combination cannot be completely predicted from the meanings of the particle and the verb individually. For example, the particle verb combination *aus•stellen* consists of *aus* 'out' and *stellen* 'put, place', but the combination has certain lexical entailments that are not predictable from the meaning of each word. The combination additionally specifies that the placed object will be on display in some manner. A natural way to use the *aus•stellen* combination would be in a discussion about displaying goods in a shop window, as in sentence (3.18a). The combination is not appropriate for generic situations of placing something out, as shown by sentence (3.18b).

(3.18a) Hans stellte seine Waren im Schaufenster aus
Hans placed his wares in-the display window out
Hans displayed his wares in the shop window

(3.18b) #Hans stellte den Mülleimer aus
#Hans placed the trashcan out
Hans put out the trash

Sentence (3.18b) is appropriate if Hans intends to display the trashcan, but not if he simply means to leave it for the garbage collector.

The fact that many particle verb combinations have conventionalized semantic content shows that the idiosyncratic content of these expressions must be listed in the

lexicon in some manner, but this does not mean that these combinations need to be regarded as single words. The semantic content of idiomatic expressions like *ins Gras beißen* , 'die', (lit. 'bite into the grass') must be represented in the lexicon in some manner as well, but there is little reason to believe that expressions like this are words, rather than phrases. As Booij (1990) argures, conventionalized meaning does not distinguish words from phrases. For path particle verb constructions, in most cases the idiosyncratic semantic content is distributed between the particle and the verb, so that the final meaning is partially motivated by both verb and particle. The semantic content of many path particle verb combinations parallels the content of what Nunberg, Sag and Wasow (1994) call idiomatically combining expressions. Of course, many other combinations like *hinaus•fahren* 'drive out' are straightforwardly compositional.

3.8 Particle verb combinations in word formation

A number of German nouns, adjectives, and adverbs correspond to combinations of path particles and verbs. Examples related to *aus•fahren* 'drive out' in (3.19a-3.19c) are typical.

(3.19a) *ausfahrbar* 'extendable by mechanical means'
Dieses Auto hat eine ausfahrbare Antenne
This car has a extendable antenna
This car has a power antenna.

(3.19b) *Ausfahrer* 'delivery person' (regional expression)
Hans ist Ausfahrer von Beruf
Hans is delivery person from profession
Hans' profession is that of delivery person.

(3.19c) *Ausfahrt* 'exit for vehicles'
Wir haben die Ausfahrt nach Hamburg verpaßt
we have the exit to Hamburg missed
We missed the exit to Hamburg

Not all path particles are equally productive. The particles *ab, an, auf, aus, ein* are highly productive, while other path particles like *hinaus, hinein, vorwärts, rückwärts, entgegen* only occur in isolated examples. The productive path particles are also the particles that commonly combine with verbs in a more conventionalized manner than do the less productive particles.

If the phrasal hypothesis is to be maintained, it is necessary to assume that word formation rules may relate phrases to words. Aside from derivations from particle verb combinations, several other kinds of words appear to be related to phrases. For example, as Uszkoreit (1987) points out, many compound nouns consist of a deverbal element and an element that corresponds to a verb dependent in a verb phrase. In words like *Umweltzerstörung* 'destruction of the environment', *Zugfahrer* 'train-driver (engineer)', *Ohrenschützer* 'ear-protectors (ear muffs)', the first element corresponds to a complement of the verb. In words like *Kurzparker* 'short-parker (short-term parker)', *Spätentwickler* 'late-developer (child development term)', *Schnellläufer* 'fast-runner (astronomical term for a type of star)', the first element corresponds to an adverbial modifier in a verb phrase. The semantic composition of both elements is similar to the composition of adjunct and verb, in that the first element describes a way of doing something, rather than a type of something. In *Kurzparker*, for example, *kurz* 'short' describes how long someone parks, not a short person who parks.

Several path particles themselves are etymologically related to phrases. Examples

include forms like *hináus* 'out', *dorthináus* 'to there out', *aufeinánder* 'on top of each other'. Most German compounds carry word accent on the first root syllable, but these compounds preserve their phrasal stress structure, unlike genuine compounds in German.

Finally, Uszkoreit (1987) points out that virtually any phrase can be nominalized by preceding the string with *das* 'the'. Uszkoreit gives the example *das Aufdensteinensitzen* 'the sitting on the rocks'.

In conclusion, because of the numerous examples where internal word structure is apparently related to or derived from phrases, the fact that some words are derived from or related to particle verb constructions is unremarkable, and provides no support for the claim that particles are morphemes, not words.

3.9 Particles change arguments in the verb

The subcategorization requirements for a verb are sometimes different when a particle occurs with the verb. This might lead one to conclude that particles are derivational morphemes, since (inseparable) prefixes also often derive new verbs with a different argument structure. In examples (3.20a-3.20b) below from Piñon (1992), verbs which occur with particles have different argument structures than the same verbs which occur without particles. In example (3.20c) below, the inseparable prefix *be-* derives a transitive accusative verb from an intransitive verb.

(3.20a) *geben* 'give' <NOM, DAT, ACC> vs. *auf•geben* 'give up' <NOM, ACC>

(3.20b) *laufen* 'run' <NOM> vs. *nach•laufen* 'run after' <NOM, DAT>

(3.20c) *arbeiten* 'work" <NOM> vs. *bearbeiten* 'work, adapt' <NOM, ACC>

The ditransitive version of geben is probably the most common, but this need not

mean that that *auf•geben* is derived directly from ditransitive *geben*, since there is a transitive (accusative) version of *geben* which means 'to put, place' as in *die Wäsche in die Waschmachine geben*, and the sense of *auf•geben* meaning 'give up' could be easily derived from this related sense 'to deposit, check through'. -- the same *geben* as in the computer term *ein•geben* 'to enter (into a computer)'. One cannot always assume that various argument structures for a verb are always derived from the most common argument structure.

The fact that the occurrence of particles has consequences for the argument structure of the verb is not surprising if verbs subcategorize for particles. Patterns in argument structure are common, and are tied to the meanings of the verbs in question (Booj 1990). For example, German verbs which denote a transfer of possession often have a dative argument which corresponds to the recipient, and an accusative argument which corresponds to the entity being transferred. This is the case for ditransitive *geben* 'give'. The occurrence of the dative argument requires the occurrence of the accusative argument.

Resultative constructions are another example. For many verbs, the occurrence of a resultant state requires the occurrence of an accusative object. Examples (3.21a-3.21b) below shows that *laufen* 'run', which is normally intransitive, subcategorizes for an accusative object and a stative adjective in a resultative construction.

(3.21a) Hans lief.
Hans ran.
Hans ran.

(3.21b) Hans lief seine Schuhe kaputt
Hans ran his shoes broken
Hans ran in his shoes until they broke.

The point is that certain types of constructions sometimes require a particular argument structure in the verb -- particle verbs are just another example. Intransitive *laufen* is related to resulative *laufen* by lexical rule -- in this sense resultative *laufen* is derived, but this does not mean that resultative expressions are single words.

3.10 Inflexible word order

Certain path particles like *ein, aus, auf, an, ab, entegegen, zu* exhibit an unusually inflexible word order compared with most verb dependents. These particles occur immediately preceding the verb when the verb occupies clause-final position, otherwise the particle occupies clause-final position. Other path particles like *hinaus* 'out', *hinein* 'in' are a bit more flexible, but are still relatively restricted. Still others like *links* 'left' exhibit as much flexibility in sentence position as do complements, verb modifiers, and path denoting prepositional phrases. Sentences (3.22a-3.22d) below demonstrate the relatively constrained sentence position of the particle *ein* 'in' with *fahren* 'drive '. The path particle *ein* must occur in clause-final position. Sentences (3.23a-3.23d) show that the position of the path particle *hinein* 'in' is a bit more flexible. The particle *hinein* must occur in clause-final position if it occurs after the verb, but unlike *ein*, it can be fronted with the accompanying prepositional phrase *in den Hafen* 'into the harbor'. Sentences (3.24a-3.24d) show that the position of the path particle *links* 'left' is most flexible. *links* can be fronted by itself, with the accompanying prepositional phrase *um die Ecke* 'around the comer', occur in final-clause position, or interspersed among other verb dependents.

(3.22a) das Schiff fuhr in den Hafen ein
the ship drove into the harbor in
the ship arrived in the harbor

(3.22b) *ein fuhr das Schiff in den Hafen

(3.22c) *das Schiff fuhr ein in den Hafen

(3.22d) *in den Hafen ein fuhr das Schiff

(3.23a) das Schiff fuhr in den Hafen hinein
the ship drove into the harbor in
the ship sailed into the harbor

(3.23b) *hinein fuhr das Schiff in den Hafen

(3.23c) *das Schiff fuhr hinein in den Hafen

(3.23d) hinein in den Hafen fuhr das Schiff

(3.24a) das Auto fuhr links um die Ecke
The car drove left around the corner
The car turned left at the corner

(3.24b) das Auto fuhr um die Ecke links

(3.24c) Links fuhr das Auto um die Ecke

(3.24d) Um die Ecke links fuhr das Auto

Olson (1997) claims that the inflexible word order of particles like *ein, aus, auf, an, ab, entegegen, zu* is due to their status as morphological elements. Olson argues that other path-denoting words like *hinaus* are full-fledged words.

It is not clear why fixed word order ought to be a property of morphological elements. It is logical to claim that the verb associated with the particle is also a morpheme, yet the position of the verb associated with the particle is not fixed at all. It occurs in all the customary verb positions where verbs without particles also occur.

Uszkoreit (1987) suggests that the inflexible word order of certain particles is due to non-compositional semantics. He argues that an autonomous semantics is necessary for a particle to be fronted. When the combination is less compositional, the word order is fixed for these expressions. This inflexibility in word order is similar to that associated

with idiomatic phrases. For example, in a sentence with the idiom *ins Gras beißen* 'die, lit. bite into the grass', it sounds odd to front the prepositional phrase, as shown in (3.25b) below. Sentence (3.25b) can only have its compositional, non-idiomatic interpretation.

(3.25a) vor kurzem hat unser Auto ins Gras gebissen
recently has our car in-the grass bitten
Our car recently bit the dust

(3.25b)*ins Gras hat unser Auto vor kurzem gebissen

**the dust, our car bit*

This explanation covers several examples, but not all of them. The combination *ein•fahren* 'drive in' carries a non-compositional entailment (that the moving object has reached an intended destination) not present in the more literal *hinein•fahren* 'drive in'. However, some particles like *entgegen* 'toward' and *zu* 'to' combine with verbs in a straightforward, compositional manner, as in sentences (3.26a-3.26b) below. I assume that the word order properties of path particles will have to be specified individually, or by lexical rule if clear patterns can be established.

(3.26a) Maria lief Hans sofort entgegen
Maria ran Hans immediately toward
Maria ran immediately toward Hans

(3.26b) Maria warf mir den Ball zu
Maria threw me the ball to
Maria threw the ball to me

3.11 Separability

In German, the position of the main verb is determined by two factors, whether the main verb is finite or not, and whether the clause headed by the verb is a main clause or dependent clause. In path particle constructions, the position of the verb and the position

of the particle is determined independently. In configurations like 3.27a below, verb dependents occur between the verb and particle. In other configurations like 3.27b below, the particle normally occurs immediately preceding the main verb at the end of the clause. In 3.27a, the finite main verb *fahren* 'drive' occurs in second position, the customary position of finite verbs in main clauses, and the particle *ab* 'off, away' occurs at the end of the clause. The verb dependents *Hans* and *unerwartet* 'unexpectedly' occur between the particle and the verb. In 3.27b, the finite verb occurs at the end of the clause, the customary position of finite verbs in dependent clauses, and the particle occurs immediately preceding the verb. Standard orthographic convention has *ab* and *fahren* written together without a space in 3.27b.

(3.27a) Gestern fuhr Hans unerwartet ab
Yesterday drove Hans unexpectedly away
Yesterday, Hans departed unexpectedly.

(3.27b) ...weil Hans gestern unerwartet abfuhr
because Hans yesterday unexpectedly away-drove
...because Hans unexpectedly departed yesterday

Not all path particles are written together with the verb without a space as shown in 3.27b. Path particles like *links* 'left' or *südlich* 'south, in a southerly direction' are written with a separating space. Other particles like *vorwärts* 'forward' and *rückwärts* 'backward' pose classic spelling problems for German speakers who find themselves reaching for a spelling dictionary because their language intuition provides no guidence.

Spelling is obviously an orthographic problem, since speakers cannot hear intervening spaces in spoken German. Given the somewhat arbitrary, conventional nature of spelling, it does not represent a valid linguistic analysis of particles and verbs. Even so, the presence or absence of that intervening space has certainly influenced the way linguists

have approached the "problem" of verb particles. For example, in Simeckova's (1993) list of "preverbal elements", *vorwärts* and *rückwärts* are listed as free adverbial elements transitioning to the formation of complex verbs, as evidenced by the more frequent occurrence of unseparated orthography in baseforms.[4] Forms like *links* 'left' were not included in the list, even though *links* and *vorwärts* have very similar meanings and distributions. The omission is presumably due to the fact that Germans rarely, if ever, write *links* together with the verb without an intervening space.

The fact that intervening material systematically occurs between verb and path particle (as in 28a) is unremarkable if the particle and verb are independent words. The separability of words from each other lies at the heart of the distinction between words and morphological elements. In fact, the phrasehood of a string would be questionable if intervening material were never allowed between the elements composing the string. This analysis, where path particles and verbs are full-fledged words preserves the Lexicalist Hypothesis, which claims that syntactic constraints have no access to word-internal structure. If path particles and verbs were morphemes, then the distinction between principles of word order and principles of morpheme order would be blurred, and the Lexicalist hypothesis is weakened.

An analysis that claims that path particles and verbs form words is more complicated because it does not predict the separability we observe, as the internal structure of other compounds in German is not transparent to rules that govern the position of elements in a sentence. In this view, particle verbs are an exception to the

[4]The 1995 official spelling reform legislated this so-called transition out of existance. After 1995, *vorwärts* and *rückwärts* are always written separate from the verb. Prior to 1995, figurative uses like *vorwärts•gehen*, 'to make progress', lit. 'to go forward'were often written together with the verb, but literal motion uses were usually written separately. See *Duden 1, Die deutsche Rechtschreibung* (1996).

Lexicalist Hypothesis.

3.12 Head type for path particles

All signs, both words and phrases, have a value for the feature HEAD, information corresponding roughly to the notion 'part of speech'. This section will argue that path particles are a distinct head type, different from nouns, verbs, adjectives, related to the head type preposition.

The *Duden Universalwörterbuch* (1989) classifies many path particles as adverbs. For example, *hinaus* 'out' is an adverb in sentences without explicit verbs like *Hinaus mit dir an die frische Luft!* 'out with you into the fresh air!'[5]. According to Duden, *adverbs* belong to the larger class of words called *particles*, the class that includes all words that are not declined. I assume that prepositions are not considered particles because they take noun phrase complements.

This notion adverb is not precise enough to make meaningful predictions about the distribution of a word or phrase. For example, Duden classifies *sehr* 'very', *abend* 'evening', and *plötzlich* 'suddenly' as adverbs, even though their syntactic distribution is quite different. Therefore, in place of *adverb*, I will assume that there are several specific head types, including *path particle*.

---

[5]Duden apparently assigns no part of speech to path particles in sentences like *Maria fuhr ihr Auto hinaus* 'Maria drove her car out', since *hinaus* in these cases is assumed to be a sublexical part of the word *hinausfahren* 'drive out'.

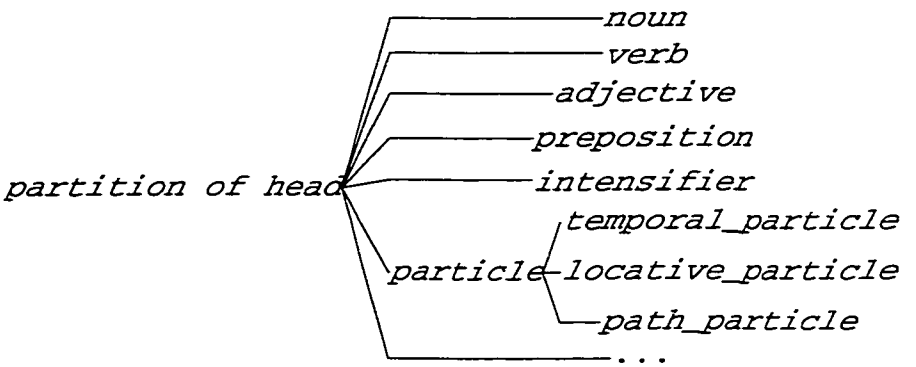

Figure 3.2: *path_particle* as a distinct head type

Path particles are similar in meaning to path-denoting prepositions, and so they occur with the same types of verb. Path particles could be called deictic prepositions, similar to path prepositions in that they define paths through space with respect to a location, different in that the location is inferred from context for path particles, but explicitly present as a noun phrase complement for a preposition.

There are many verb particles in German that do not denote paths, found in combinations like *Auto fahren* 'to car-drive', *auf essen* 'to eat up (completely)', *auf machen* 'make open', *leer trinken* 'drink empty', *kennen lernen* 'to learn to know'. These words are also undeclined, and they often exhibit similar word order constraints. Beyond that, however, it is clear that the semantic content of these particles differs greatly, as does their semantic composition with the verb. These various types of verb particle exhibit different properties. For example, *Auto* in *Auto fahren* is obviously related to the noun *Auto*, and in some sense fills an argument slot in the verb relation, while *auf* in *auf machen* closely resembles an adjectival predicate, shown by the fact that *auf* will take a degree modifier in sentences like *Hans machte das Fenster ganz auf* 'Hans completely opened the window'. Because the common notion of 'verb particle' or 'separable prefix' is based on a collection of

unrelated criteria like orthography, less-compositional semantics, and word order, it is not very useful for establishing a part of speech.

3.13 List of path-denoting particles in German

The following table lists all German path particles. The class of path particles is, for the most part, a closed class, since the need for novel notions of spacial relations, orientation in space, or movement through space does not arise. Excluded from this list are words like like *aufeinander* 'at one another', *dorthin* 'to there', *davon* 'from there', which are essentially lexicalized prepositional phrases. Also excluded from the list are directional adverbs like *links* 'left', *rechts* 'right', *geradeaus* 'straight ahead', *vorwärts* 'forward', *rückwärts* 'backward'. Directional adverbs can occur with path particles in the same sentence, as in example (3.30).

(3.28) Biegen Sie an der nächsten Ecke links ein
Turn you on the next corner left in
Turn left at the next corner.

Each path particle listed below is accompanied by an example sentence, and an English translation. Example sentences are mostly taken from the COSMAS corpus search engine provided by the *Institut für deutsche Sprache* (IDS), the *Duden Universalwörterbuch* (1989), and the *Duden Stilwörterbuch* (1988).

ab	Peter reiste plötzlich ab *Peter departed suddenly*
an	Peter fuhr eine alte Frau an *Peter hit an old lady*
auf	der Lastwagen fuhr den Pkw auf *the truck hit the car*

aus	Am Wochenende fährt die ganze Familie aus *on the weekend, the whole family goes out by car*
bei	dem Blumenstrauß legte er eine Karte bei *he laid a card next to the bouquet*
durch	Peter lief durch die Absperrung durch *Peter ran all the way through the barrier*
ein	der Zug fuhr pünktlich ein *the train pulled in on time*
entgegen	Peter lief seinem Freund freudig entgegen *Peter ran joyfully toward his friend*
entlang	die Kinder stellten sich an den Fenstern entlang auf *the childern placed themselves along the windows*
fort	Aus Angst lief er fort *out of fear, he ran away*
geradewegs	wir fuhren geradewegs ins Stadtzentrum *we drove straight into the center of the city*
geradeaus	das Mädchen fuhr geradeaus auf dem Radweg *the girl rode straight ahead on the bike path*
her	die Kassiererin lief hinter ihm her und versuchte ihn festzuhalten *the cashier ran after him and tried to detain him*
herab	eine Familie ließ sich an Bettüchern auf die Straße herab *a familie let themselves down onto the street using bedsheets*
heran	der Täter schlich sich von hinten an die Frau heran *the assailant slinked up to the woman from behind*
herauf	ohne Ortskenntnis kann keiner den Rhein herauf oder herunter fahren *nobody can navigate up or down the Rhine without knowing the local geography*
heraus	sie fuhr den Wagen aus der Garage heraus *she drove the car all the way out of the garage*
herbei	Hausbewohner riefen die Polizei herbei. *residents called the police to the scene*

herein	die Tür öffnete sich, und die Schwester kam mit der Arznei herein *the door opened, and in came the nurse with the medication*
hernieder	aus der Stratosphäre senkt sich ein Raumschiff hernieder *a spaceship came down out of the stratosphere*
herüber	also fuhr er mit seiner Familie herüber, den alten Kontinent zu studieren *so he traveled over with his family to study the old continent*
herum	der Hund lief vor seinen Besucherinnen herum *the dog ran around in front of his visitors*
herunter	doch sooft ich etwas hochwarf, kam es sofort wieder herunter *every time I threw something up in the air, it came back down immediately*
hervor	die Schauspielerin sprang hinter dem Vorhang hervor *the actress jumped out from behind the curtain*
herzu	ein schneeweißer Hirsch kam herzu und stand neben sie still *a snow-white deer came up to them and stood still next to them*
hier	Peter setzte sich einfach in einen Zug und kam via Frankfurt hier an *Peter simply got on a train and arrived here via Frankfurt*
hierher	eine andere Aussiedlerin aus Rumänien erzählt von ihrer Einsamkeit, bevor sie hierher kam *another immigrant from Romania tells of her loneliness, before she came here*
hierhin	noch einmal würde ich nicht hierhin reisen *I wouldn't travel from here to there again*
hin	Globetrotter und Reisejournalisten fahren immer wieder hin *Globetrotters and travel journalists travel there again and again*
hinab	der 26jährige rutschte mit seinem Pkw die Böschung hinab *the 26-year-old slid down the embankment with his car*
hinan	sie stiegen den Hügel hinan und lagerten sich bei einer großen Eiche *they climbed up the hill and made camp by a big oak*
hinaus	die Braut lief weinend hinaus und setzte sich in den Wagen *the bride ran out crying and got into the car*
hinauf	er stieg zum Schloß hinauf und war vom Zauber dieser Trümmer gefangen *he climbed up to the castle and was caught by the magic of these ruins*

hindurch	ein 29jähriger Radfahrer fuhr plötzlich zwischen den geparkten Fahrzeugen hindurch auf die Fahrbahn *a 29 year-old cyclist rode suddenly through between the parked cars onto the roadway*
hinein	das Mädchen lief vom Wege ab in den Wald hinein und suchte Blumen *the girl ran off the path into the forest and looked for flowers*
hinterher	"Ich weiß nicht", sagte die Frau und hastete ihrem Einkaufswagen hinterher *"I don't know", said the woman and hurried after her shopping cart*
hinüber	eines Tages bestiegen wir den Zug und fuhren nach Mannheim hinüber, um uns "König Lear" anzusehen *one day we got on the train and went over to Mannheim to see "King Lear"*
hinunter	der 69jähriger Mann stürzte die Böschung hinunter und blieb dort liegen *the 69 year-old man fell down the embankment and remained lying there*
hinweg	die Unglücksmaschine schoß kurz vor ihrem Absturz im Tiefflug über die Stadt hinweg *shortly before its crash, the unfortunate plane shot over the city flying at a low level*
hoch	die Vögel flogen hoch *the birds flew high*
links	biegen Sie an der nächsten Ecke links ein *turn left at the next corner*
nach	den ganzen Tag gingen sie der Spur nach *all day, they went after the scent*
nieder	der Stein fiel ganz kurz vor meinem Wagen nieder *the stone fell down very close to the front of my car*
ran	s. heran
rauf	s. herauf
raus	s. heraus
rein	s. herein
rüber	s. herüber
rum	s. herum

runter	s. herunter
über	der 29jähriger Mann fuhr einen Fußgänger über *the 29 year-old man ran over a pedestrian*
um	Peter ging das Problem um *Peter went around the problem*
umher	auf dem Platz selbst rannten Kindergruppen lärmend umher *on the square itself, groups of children ran around noisily*
unter	das Schiff ging unter *the ship went under*
vor	der Möbelwagen fuhr vor dem Haus vor *the furniture truck pulled up in front of the house*
vorbei	er fuhr zunächst mit dem Rad an ihr vorbei und erwartete sie dann am Ende der Straße *first, he rode past her on her bike and then awaited her at the end of the street*
weg	die Frau stand hastig auf und lief weg, vergaß in der Panik aber ihr Sitzkissen *the woman stood up hastily and ran away, and in her panic forgot her seat cushion*
zu	der Mann lief seinem Sohn zu und umarmte ihn *the man ran up to his son and embraced him*
zurück	ich fliege heute noch nach Paris zurück *I'm flying back to Paris yet today*

Chapter 4: Syntactic Structure of Motion Verbs with Path Expressions

4.0 Introduction

This chapter argues that in sentences like (4.1a-c), the grammatical relation between the motion verb and path expression is a head-complement relation, (an instance of a *hd-comp-ph*). In (4.1a), the path-denoting prepositional phrase *aus dem Haus* 'out of the house' is a complement of the head verb *lief* 'ran'. The verb *laufen* 'run' is a subtype of motion verb called *manner of motion* verbs, where the verb's semantic relation specifies the manner in which the subject changes location.

(4.1a) Hans lief aus dem Haus
Hans ran out the house
Hans ran out of the house

In (4.1b), the path-denoting particle *hinaus* 'out' is a complement of the head verb *warf* 'threw'. The verb *werfen* 'throw' is a subtype of motion verb called *cause motion* verbs, where the verb's semantic relation entails that the referent of the subject causes the referent of the accusative object to change location.

(4.1b) Hans warf den Ball hinaus
Hans threw the ball out
Hans threw the ball out

In (4.1c), the path-denoting prepositional phrase *auf den Tisch* is a complement of the head verb *legte* 'laid'. The verb *legen* is a subtype of cause motion verb called *placement* verbs, where in addition to the cause motion entailment, the resultant spatial orientation of the accusative object is also specified. In the case of *legen*, the accusative object is entailed to occupy a lying position as a result of the action of the verb.

(4.1c) der Junge legte das Buch auf den Tisch
the boy laid the book on the table
the boy laid the book on the table

Section 4.1 sets the context for discussing the grammatical relation of path expressions by presenting the formal differences between complements and adjuncts in HPSG terms. In a head-complement phrase (*hd-comp-ph*), the head verb selects its complements and associates them with roles in the verb relation. In a head-adjunct phrase (*hd-adjunct-ph*) the adjunct selects the head verb, with the adjunct selecting the head verb, and the semantic content of the verb is associated with a role in the semantic relation of the adjunct.

Section 4.2 argues that paths resemble complements in that the way the path is integrated with the verb semantics varies according to verb type. If paths were adjuncts, we would expect a fairly uniform contribution across different types of verb.

Section 4.3 explains that complements are associated with roles in verb relations, while adjuncts are not. This difference explains why complements are, in a sense, less optional than adjuncts.

Section 4.4 argues that path expressions with motion verbs resemble complements in that they exhibit reduced optionality as described in section 4.3. Several examples show cases where path expressions are required to explicitly occur in order to form a grammatical sentence. In other cases where path expressions do not occur with motion verbs, it is argued that while the linguistic expression of the path may be optional, the semantic content of the path is not. When speakers don't specify the path, the listener must infer a path. Section 4.5 argues that the notion of path is crucial in defining motion relations. Paths are associated with a role in motion verb relations as a complement.

Section 4.6 introduces the problem of explaining the structure of multiple path expressions with a single motion verb, and concludes that such constructions are a combination of complements and adjuncts. Section 4.7 argues against an analysis of multiple path expressions where the paths form a single phrase. Section 4.8 argues against an analysis of multiple path expressions where each path expression is a complement sister of the head verb. Section 4.9 argues that the most appropriate analysis for multiple path expressions is one where a single path is a complement, and any remaining path expressions are adjuncts. Section 4.10 argues that more than one path-denoting particle may not occur with a motion verb because path particles only occur as complements, not adjuncts, and motion verbs subcategorize for at most one complement.

4.1 The formal differences between complements and adjuncts in HPSG

Pollard and Sag (1994) and Sag (1997) explicitly assert that among verb dependents, there is a difference between complements and adjuncts. Complements are selected lexically by the verb via the verb's COMPS list, and are assigned a role in the semantic relation of the verb. For example, the transitive verb *fressen* 'eat like an animal' subcategorizes for a accusative noun phrase complement, and identifies the INDEX of the complement with the UND role in the verb relation. In figure (4.1), a partial lexical entry for the verb *fressen*, the numbered tags show that the verb lexically identifies the INDEX value of the subject with the ACT role in the verb relation, and identifies the INDEX value of the complement with the UND role in the verb relation.

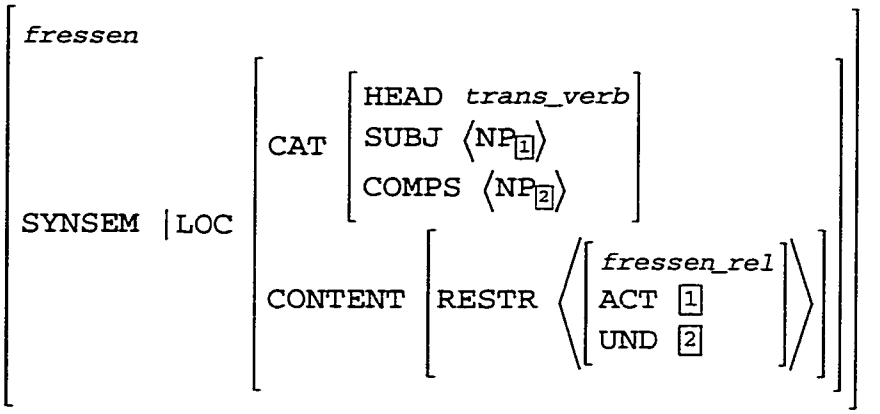

Fig. 4.1: partial lexical entry for *fressen* 'eat like an animal'

Adjuncts differ from complements in that an adjunct selects the verb via the adjunct's MOD feature. In cases where scope is not an issue, the argument role in the semantic relation of the adjunct is identified with the situation-index value of the modified verb phrase. Fig. 4.2 below shows a partial lexical entry for the adverb *gierig* 'greedily', expressing the manner in which an entity might do something (like eating, for example). This modifier selects a verb phrase whose situation-index is 1 , and identifies this situation-index with the ARG value of its own semantic relation.

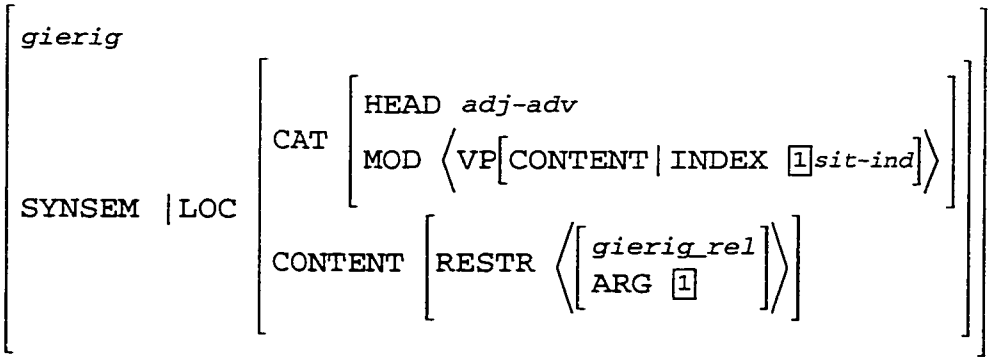

Fig. 4.2: partial lexical entry for the VP modifier *gierig*

In short, the formal difference between complements of verbs and adjuncts of

verbs lies in the "direction" of selection. Complement dependents of verbs are licensed (and required) to occur by virtue of being selected by the verbal head. Adjunct dependents of verbs select the verbal head, and are not required to occur at all. The occurrence of adjunct dependents of verbs is contingent on the availability of an appropriate type of verb head.

4.2 The semantic contribution of path expressions varies across head types

Because complements are lexically associated with a role in the verb relation, the verb may integrate the semantic content of its complements with its own semantic content in a relatively idiosyncratic way (see Pollard and Sag 1987). For example, (4.2a-b) show that the noun *Maria* can be integrated with verb relations in different ways. In (4.2a), the dative complement *Maria* is associated with a role in the verb relation corresponding to the recipient of the giving. Example (4.2a) entails that Maria takes possession of the pencil. In (4.2b), the dative complement *Maria* is associated with a role corresponding to the entity losing possession.

(4.2a) Peter gab Maria den Bleistift
Peter gave Maria the pencil
Peter gave me the pencil

(4.2b) Peter nahm Maria den Bleistift
Peter took Maria the pencil
Peter took the pencil from Maria

The variety in semantic integration of a verb with a dependent as shown in (4.2a-b) is characteristic of head-complement phrases. The lexical entry of the verb determines precisely how the semantic content of its complements are integrated with its own content.

Adjuncts are not lexically specified by the verb, and are therefore expected to

make a fairly consistent semantic contribution to a variety of verb relation types. For example, temporal expressions like *yesterday* and locative expressions like *at the store* typically make predictable semantic contributions to a variety of verb relations. In (4.2c-d) below, the semantic contribution of the adjunct *gestern* 'yesterday' is constant for both *geben* 'give' and *nehmen* 'take'.

(4.2c) Peter gab Maria den Bleistift gestern
Peter gave Maria the pencil yesterday
Peter gave Maria the pencil yesterday

(4.2d) Peter nahm Maria den Bleistift gestern
Peter took Maria the pencil yesterday
Peter took the pencil from Maria yesterday

The lexical entry of the adjunct determines how the semantic content of the verb is integrated with its own semantic content, as illustrated in Fig. 4.2. Consistency in the semantic integration of a verb with a dependent as shown in (4.2c-d) is characteristic of head-adjunct phrases.

The semantic contribution of path expressions is consistent in combination with verbs that entail motion in that the path consistently constrains the trajectory of the entity entailed to move. However, exactly which entity is entailed to move (ACT or UND, for example) varies according to the type of motion verb. In (4.3a) below, *Maria*, corresponding to the ACT role of the manner-of-motion verb *laufen*, is entailed to move. In (4.3b), *Ball*, corresponding to the UND role of the cause-motion verb *werfen* 'throw', is entailed to move. In (4.3c), *Maria* is again the moving entity with *laufen*. Examples (4.3a-c) show that even among motion verbs, some variation in semantic integration occurs.

(4.3a) Maria lief aus dem Zimmer
Maria ran out the room
Maria ran out of the room

(4.3b) Maria warf den Ball aus dem Zimmer
Maria threw the ball out the room
Maria threw the ball out of the room

(4.3c) Maria lief ihrem Vater entgegen
Maria ran her father toward
Maria ran toward her father

Some verbs like *schauen* 'look', *scheinen* 'shine' do not entail motion, but nevertheless combine with paths. Not surprisingly, these verbs integrate the semantic contribution of their path complements somewhat differently. The activity of the verb is directed along a path, but the path is not associated with one of the verb dependents as was the case in (4.3a-c). Verbs like *scheinen* 'shine' and *schauen* 'look' show more examples of the variation in semantic integration typical of complements rather than adjuncts.

(4.3d) die Sonne scheint ins Zimmer
the sun shines in-the room
the sun is shining into the room

(4.3e) Maria schaute Hans an
Maria looked Hans on
Maria looked at Hans

(4.3f) Maria schaut durch das Fernrohr
Maria looks through the telescope
Maria is looking through the telescope

4.3 Complements are associated with roles in verb relations

Semantic roles in verb relations identify entities or situations that are integral to the verb predicate. For example, the semantic relation for the verb *fressen* 'eat like an animal' has two roles, an ACT role corresponding to the eating entity, and an UND role corresponding to the eaten entity. Both the 'eater' and the 'eaten' are integral to the *fressen*

relation. In order to be a *fressen* situation, both an eater and an eaten entity are required. Similarly, the semantic relation for the verb *geben* 'give' inherently involves three entities corresponding to a giver, a recipient, and a gift. Verbs like *fressen* and *geben* associate the subject with one role in the verb relation, and associate the remaining roles with complements.

By contrast, adjuncts are not associated with roles in verb relations because they are not integral to the meaning of the verb relation. As an example, for semantic relations for verbs like *fressen* or *geben*, specification of time or place is not a defining characteristic of the relation. The definition of a *fressen* or *geben* situation does not depend on where or when the situation takes place. So time and place relations are adjuncts, not associated with roles in the verb relation. In this sense, adjuncts are optional in a way that complements are not.

Complements, being integral to the meaning of the verb relation, are either explicitly required by the verb to form a grammatical sentence, or the semantic content of the complement must be specified contextually. In this sense, complements are less optional than are adjuncts, which are completely optional, and need not be recovered from context.

For example, common uses of *geben* 'give' omit either an explicit reference to a recipient or both explicit recipient and gift. In sentence (4.4a), *geben* occurs without an explicit recipient, and in sentence (4.4b), *geben* occurs without either an explicit recipient or an explicit gift.

(4.4a) die meisten Anwesenden gaben einen Scheck über 300 Mark
the most present-ones gave a check over 300 marks
most of those present gave a check for over 300 marks

(4.4b) Maria gibt gern
Maria gives gladly
Maria is generous

Sentence (4.4b) does not specify what is given, or who is the recipient of the giving, although somebody must receive something for a situation to be an instance of giving. Depending on the context, the sentence may be referring to money to a charity, or presents for Maria's friends. As an example, (4.5) below provides a context for (4.4b) that specifies Maria's son as the recipient and the given entity as a Porsche automobile.

(4.5) A: Ich sah Marias Sohn heute mit einem neuen Porsche.
I saw Maria's son today with a new Porsche.

B: Ja, Maria gibt gern, obwohl sie es nicht leisten kann.
Yes, Maria gives gladly, although she can't afford it.

Similarly, sentence (4.4a) does not specify the recipient, and is completely appropriate if the speaker expects that the listener can infer the recipient from context. For example, if the topic of conversation had been previously established to be a political fund-raiser or a charity event, then the listener can be expected to infer who the recipient is.

Sentences with unexpressed complements are not acceptable with every use of a verb. For example, sentences like ?*Maria gibt* 'Maria gives' sound odd. Certain verb usages seem to license complement dropping more than others. In sentences (4.4a-b), *geben* is used in an iterative sense, where repeated instances of giving are considered in mass. *Maria gibt gern* entails multiple instances of giving on different occasions. Within the context of (4.5), Maria giving her son a car is one giving instance with a recipient and gift in a series of giving instances. Similarly, the check-giving example in (4.4a) entails multiple instances of

giving on the same occasion. Using verbs in conventional or idiomatic expressions (see (4.7) below) also sometimes licenses unexpressed complements. An investigation into the factors licensing unexpressed complements is needed, but is beyond the scope of this thesis.

In contrast to complements, adjuncts are more optional. Because adjunct semantic content is not associated with a role in the verb relation, adjuncts are never required to appear, nor must their semantic content be recovered from context. For example, defining an instance of giving does not require a location or time for the giving. Adjunct semantic content is always optional.

4.4 Motion relations require path relations

The previous section showed that because complements are associated with roles in a relation, complements must either explicitly occur or be specified by the context. This section argues that with different sorts of motion verb relations, path relations must either explicitly occur or be specified by context, and therefore path expressions are complements of motion verbs. Section 4.4.1 demonstrates that path expressions are required with placement verbs. Section 4.4.2 demonstrates that path expressions are required with cause-motion verbs. Section 4.4.3 demonstrates that path expressions are required with manner of motion verbs. Section 4.4.4 demonstrates that path expressions are required with certain path-denoting particles. Section 4.4.5 demonstrates that path expressions are sometimes required in conjunction with motion verbs having a specific type of dative object called the *Zugehörigkeitsdativ* 'dative of pertinence'.

4.4.1 Placement verbs

Path complements are explicitly required for verbs of placement. For example, when the placement verb *legen* 'lay' entails motion, it requires a path expression, as shown by examples (4.6a-b). In (4.6a), *legen* occurs with the path expression *auf den Tisch*. But it is hard to imagine a context in which (4.6b), the same sentence without the path, would be acceptable.[1]

(4.6a) Hans legte das Buch auf den Tisch
Hans laid the book on the table
Hans laid the book on the table

(4.6b) *Hans legte das Buch
Hans laid the book
**Hans laid the book*

The fact that the motion placement verb *legen* requires an explicit path is good evidence that the path is a complement, associated with a role in the verb relation, rather than an adjunct. Other placement verbs include *stellen* 'place upright', *hängen* 'hang', and *setzen* 'set'.

4.4.2 Cause-motion verbs

Path complements are routinely unexpressed for cause-motion predicates like *werfen* 'throw', as shown by example sentences (4.7a-b). In (4.7a), *werfen* occurs with the path expression *hinaus* 'out'. In (4.7b), *werfen* occurs without an explicit path.

(4.7a) Maria warf den Ball hinaus
Maria threw the ball out
Maria threw the ball out

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[1]Certain uses of *legen* do not commonly occur with path expressions, but a change of location is not entailed in these situations. For example, in *Hans legte seinen Gegenspieler, und dabei riskierte eine gelbe Karte* 'Hans laid (knocked down) his opponent, thereby risking a yellow card', no path is required, but change of location is not entailed either.

(4.7b) Maria warf den Ball
Maria threw the ball
Maria threw the ball

When *werfen* is used reflexively, sentences without path expressions are no longer acceptable, as shown by sentences (4.8a-b). In (4.8a), *werfen* occurs with the reflexive pronoun *sich* 'himself' and the path expression *auf den Boden* 'on the floor'. The same sentence without the path in (4.8b) is unacceptable.

(4.8a) Hans warf sich auf den Boden
Hans threw himself on the floor
Hans threw himself on the floor

(4.8b) *Hans warf sich
Hans threw himself
**Hans threw himself*

Sentences (4.8a-b) may represent a particular instance of a general distribution pattern for cause motion verbs like *werfen* 'throw'. If the thrown entity is a person, the path may not remain unexpressed. Example (4.9a) does not have an explicit path expression, and is not an acceptable sentence, while the same sentence with a path (4.9b-c) is acceptable.

(4.9a) ?wir warfen Maria
we threw Maria
?we threw Maria

(4.9b) wir warfen Maria ins Wasser
we threw Maria in-the water
we threw Maria into the water

(4.9c) wir warfen Maria hinein
we threw Maria in
we threw Maria in

With *werfen*, a path expression is virtually required in some contexts, but may not

explicitly occur in others. This sort of distribution is consistent with the distribution of complements, as in the case of *geben* 'give' discussed earlier. By contrast, an analysis where path expressions are adjuncts does not predict that a verb might require a path expression with certain (verb) meanings.

Certain cause-motion verbs like *blasen* 'blow' do not normally occur without a path expression, as shown by (4.10a-b) below. In (4.10a), with the path expression *auf die Erde* 'on the ground', *blasen* means something like 'cause to move by blowing'. The same sentence without the path (4.10b) is unacceptable. The fact that the path expression is required for cause-motion *blasen* shows that path expressions are complements rather than adjuncts.

(4.10a) Hans blies die Krümel auf die Erde
Hans blew the crumbs onto the ground
Hans blew the crumbs onto the ground

(4.10b) *Hans blies die Krümel
Hans blew the crumbs
**Hans blew the crumbs*

4.4.3 Manner of motion verbs

Manner of motion verbs like *laufen* 'run', *fliegen* 'fly' are intransitive verbs where the subject is entailed to move through space in a specified manner. Path expressions are not always required to occur explicitly with these verbs, as shown by (4.11a-d) below. In (4.11a), the motion verb *fliegen* 'fly' occurs with the path expression *auf den Baum* 'onto the tree'. In (4.11b), *fliegen* occurs without a path. In (4.11c), the motion verb *laufen* 'run' occurs with the path expressions *aus dem Haus* 'out the house' and *hinaus* 'out'. In (4.11d-e), *laufen* 'run' occurs without path expressions.

(4.11a) der Vogel flug auf den Baum
the bird flew onto the tree
the bird flew onto the tree

(4.11b) der Ballon flog sehr schnell
the balloon flew very fast
the balloon flew very fast

(4.11c) Hans lief aus dem Haus hinaus
Hans ran out the house out
Hans ran out of the house

(4.11d) In den Ferien sind wir jeden Tag fünf Stunden gelaufen
in the holidays are we every day five hours ran
On vacation, we walked five hours every day

(4.11e) Maria mußte laufen, um den Bus noch zu bekommen
Maria must (pret) run in-order the Bus still to get
Maria had to run to get the bus

If change of location is entailed in (4.11b) and (4.11d-e), then the listener must infer what the path of motion is likely to be. In (4.11e), the most likely path leads to the bus. Example (4.11e) is similar to the *gibt gern* 'gives gladly' example in (4.4b), in that a series of *laufen* situations is being referred to, with each instance of *laufen* possibly directed along a different path. As discussed earlier, this sort of verb usage commonly allows complements to be unexpressed. In (4.11b), because of our pragmatic knowledge about hot-air balloons, motion with respect to the ground is perhaps most likely -- a path like *über die Erde* 'over the ground' would be appropriate.

The idea that motion relations require path relations is not surprising in light of the fact that motion is relative. An entity can only be in motion with respect to some other entity. A motion relation holds between two entities if their speed and/or direction of travel differ. For example, two people riding in a car are not at motion with respect to each other, although they are in motion with respect to the ground (road). So in order for a

verb like *laufen* 'run' to have a change of location entailment, it is necessary to explicitly specify or imply what the motion is relative to.

Some verbs like *holpern* 'shake', *wackeln* 'wobble', *stolpern* 'stumble' do not entail change of location unless they occur with an explicit path expression. The examples (4.12a-c) show that when these verbs denote motion in conjunction with a path expression in the perfect tense, they select the auxiliary verb *sein* 'to be', as is usual for motion verbs. When they occur without path expressions in the perfect tense, they select the helping verb *haben* 'have'.

Example (4.12a) shows the verb *holpern* 'shake' with the path expression *über das Pflaster* 'over the cobblestones'. In this example, the proper aux verb is a form of *sein* 'to be', and motion is entailed. Example (4.12b) shows the same verb without a path expression. In this example, the proper auxiliary verb is *haben* 'have', and motion is not entailed. Example (4.12c) shows that a path expression is required in order for a form of *sein* to occur.

(4.12a) der Karren ist über das Pflaster geholpert
the hand-cart is over the cobblestones shaken
the hand-cart shook it's way over the cobblestones

(4.12b) *der Karren hat über das Pflaster geholpert
the hand-cart has over the cobblestones shaken

(4.12c) der Karren hat geholpert
the hand-cart has shaken
the hand-cart shook

(4.12d) *der Karren ist geholpert
the cart is shaken

Assuming that selection of the helping verb and the motion entailment are properties of *holpern*, then the fact that these properties only co-occur with path expressions shows that the path expression must be selected by the verb to form acceptable

sentences. Treating the path expression as a selected dependent (complement) makes accounting for this distribution straightforward. The lexical variant of *holpern* that entails motion (4.12a) selects the helping verb *sein* and a path expression. As (4.12d) shows, the path is required. The lexical variant of *holpern* that does not entail motion (4.12c) selects the helping verb *haben*, and does not allow a path expression, as shown in (4.12b).

An analysis where path expressions like *über das Pflaster* are verb adjuncts cannot account for the distribution of these path expressions. Adjuncts cannot be required to occur, so it is impossible to require the occurrence of the path in sentences like (4.12a).

4.4.4 Path-denoting particles that only occur in conjunction with a dative object

Certain path-denoting particles like *entgegen* 'toward', *zu* 'to', *nach* 'after' only occur with verbs that have dative objects. Sentence (4.13a) shows the particle *entgegen* 'toward' with the manner of motion verb *laufen* 'run'. Sentences (4.13b-c) show that the occurrence of the path particle and the dative object are linked -- neither will occur without the other.

(4.13a) Hans lief seinem Vater sofort entgegen
Hans ran his father immediately toward
Hans ran immediately toward his father

(4.13b) *Hans lief sofort entgegen
Hans ran immediately toward

(4.13c) *Hans lief seinem Vater
Hans ran his father

The dative object and the path particle are linked semantically, in that the dative object fills a role in the path particle's semantic relation, yet the dative object and path particle do not form a phrase. In (4.11a), the verb modifier *sofort* 'immediately' intervenes

between the dative object and the path particle. In principle, any number of verb dependents may intervene, showing that the path particle and dative object do not form a phrase. Both *seinem Vater* and *entgegen* are dependents of the head verb *laufen*.

An analysis where path particles like *entgegen* and dative objects are verb complements can account for the distribution of these "dative path particles" and dative objects. The lexical entry for *laufen*+dative path particle subcategorizes for both a dative object and a dative path particle. Each must occur in order to fulfill the verb's subcategorization requirements. No lexical variants of *laufen* exist that allow a dative object or dative path particle to occur without the other.

An analysis where either the dative object or the dative path particle is an adjunct cannot account for the distribution of dative path particles with dative objects. Because adjuncts are not integral to the semantics of verb predicates, the occurrence of an adjunct with a verb must be optional. A verb cannot require the occurrence of an adjunct, because all subcategorization requirements of the verb must be expressed in the verb's valence features (SUBJ, COMPS, SPR), and any subcategorized element is by definition not an adjunct. Also, adjuncts may not require the occurrence of other adjuncts, because the adjunct's MOD feature has not access to the phrase structure of the modified phrase, being limited to SYNSEM information. There is no way for an adjunct to insure the presence of another adjunct.

4.4.5 *Zugehörigkeitsdativ* 'dative of pertinence'

The *Zugehörigkeitsdativ* 'dative of pertinence' (Duden 1995) is a lexical variation of motion verbs requiring a path expression and a dative object. The dative object specifies the entity for whom the action of the verb is somehow relevant, without attributing a sense

of agency to the entity. Movement is entailed of the subject. For example, in sentences (4.14a-b), the dative object *ihm* 'him' portrays the driver of a car involved in an accident with a pedestrian more like a victim than an active agent. In these sentences, the path expression is required to explicitly occur, and may not be supplied by context, as shown by the unacceptability of (4.14c-d).

(4.14a) die Frau lief ihm plötzlich ins Auto
the woman ran him suddenly in-the car
the woman suddenly ran into his car (and was run over)

(4.14b) der Junge lief ihm plötzlich vor die Räder
the boy ran him suddenly in-front-of the wheels
the boy suddenly ran in front of his wheels (and was run over)

(4.14c) *die Frau lief ihm plötzlich
the woman ran him suddenly

(4.14d) *der Junge lief ihm plötzlich
the boy ran him suddenly

Because the path expressions are required to explicitly occur in order to form acceptable sentences in (4.14a-d), the paths must be complements, not adjuncts.

4.5 How path expressions are integral to motion relations

This section argues that path expressions play essential roles in motion relations just like complements in other types of verb relation. Just as the roles corresponding to giver, gift, recipient help define a *geben* 'give' situation, path expressions help define motion relations.

Motion relations entail that the location of an entity changes. Two general sorts of path relations specify what the motion is relative to. One sort of path relation, the spatial movement path relation, denotes an underspecified continuous (unbroken) curve through

space. The moving entity is entailed to follow this curve, so motion is relative to this curve. Sentence (4.15a-b) show examples of path expressions that entail spatial movement.

(4.15a) der Vogel flog durch die Luft
the bird flew through the air
The bird flew through the air

(4.15b) Hans lief den Fluß entlang
Hans ran the river along
Hans ran along the river

The other motion-defining relation sort is the bounded movement entailment, where motion is defined by specifying a start point of motion, and end point of motion, or both. Sentences (4.16a-c) show examples of bounded motion. In (4.16a), bounded motion is entailed, but not spatial motion. In (4.16b), even though a path through space following a river exists between Heidelberg and Mannheim, spatial movement relations like *entlang* 'along' are not appropriate, since electronic fund transfers depart and arrive, but do not physically follow curves through space. In (4.16c), both bounded and spatial motion are entailed.

(4.16a) Maria schickte 1000 Mark nach Chicago, bevor sie in die USA ankam.
Maria sent 1000 Marks to Chicago, before she in the USA arrived.
Maria sent 1000 Marks to Chicago before she arrived in the USA

(4.16b) ?Maria schickte 1000 Mark den Fluß entlang nach Mannheim
Maria sent 1000 Marks the river along to Mannheim
Maria sent 1000 Marks along the river to Mannheim.

(4.16c) Maria lief von der Bibliothek durch den Tunnel zum Hörsaal
Maria ran from the library through the tunnel to-the lecture hall
Maria ran from the library through the tunnel to the lecture hall

Manner of motion verbs like *laufen* 'run' or *fliegen* 'fly' allow motion to be defined

as either bounded or spatial, or both. Cause-motion verbs like *werfen* 'throw' that entail induced motion implicitly specify bounded motion, since a starting point is implicit when an entity at rest is set in motion. Placement verbs like *legen* 'lay' implicitly entail bounded motion, since an ending point is implicit when an entity in motion comes to occupy a stationary position.

Motion situations require one or both of the motion-defining entailments, either spatial motion or bounded motion. Motion entails a change of location, and therefore requires some way to measure or define change of location. One can imagine an entity following a curve through space (spatial motion), or compare starting and ending points (bounded motion), or both. The entailments that path expressions provide are essential to motion relations, just like notions of recipient, gift, and giver are essential to *geben* 'give' relations. A role or roles for paths in motion relations should be represented in motion relations.

4.6 Multiple paths with motion verbs

Examples (4.17a-c) show multiple path expressions occurring with a single motion verb. In (4.17a), the path-denoting prepositional phrases *von dem Tierpark* 'from the zoo', *durch den Tunnel* 'through the tunnel', and *zum Bismarckplatz* 'to Bismarck square' all occur with the manner of motion verb *fuhr* 'drove'. In (4.17b), the prepositional phrase *aus dem Fenster* 'out the window' and the path particle *hinaus* 'out (away from speaker)' occur with the cause motion verb *warf* 'threw'. In (4.17c), the path-denoting prepositional phrases *auf den Tisch* 'on the table' and *neben die Vase* 'next to the vase' occur with the placement verb *legte* 'laid'.

(4.17a) der Bus fuhr von dem Tierpark durch den Tunnel zum Bismarkplatz
the bus drove from the zoo through the tunnel to Bismarck square
the bus drove from the zoo through the tunnel to Bismarck square.

(4.17b) Maria warf den Ball aus dem Fenster hinaus
Maria threw the ball out the window out
Maria through the ball out of the window

(4.17c) Hans legte das Buch auf den Tisch neben die Vase
Hans laid the book on the table next-to the vase
Hans laid the book on the table next to the vase

Sections 4.7-4.9 each examine a possible analysis for the phrase structure of sentence like (4.17a-c). Section 4.7 argues against a phrase structure analysis where the path expressions form a single phrase. It is argued that multiple path expressions need not occur adjacent to each other in all contexts, providing strong evidence that they do not form a phrase. It is also argued that this Single Phrase analysis does not provide a way to account for the selectional properties of placement verbs like *legen* 'lay', which allow certain types of path phrases like *auf den Tisch* 'on the table', but not others, like *aus seiner Büchertasche* 'out of his bookbag'.

Section 4.8 argues against an analysis where each path expression is a complement sister to the head verb. As shown in previous sections, a path expression is required with some motion verbs in some circumstances, evidence for the complementhood of a single path expression. However, no examples exist where a motion verb requires more than one path, or a motion verb does not allow more than one path. All path expressions beyond the first are completely optional, evidence against the complementhood of all path expressions. In previous sections it was argued that paths are an intrinsic component of motion relations, since motion is relative, and must be defined with respect to some entity,

whether explicitly or implicitly. However, it does not appear that the degree to which the path is specified is relevant to motion relations.

Section 4.9 argues for an analysis where one path expression is a complement, while any additional path expressions are adjuncts to the verb, predicting the complete optionality of the additional paths.

4.7 Multiple path expressions do not form a phrase for some verb types

Combinations of path expressions may occur fronted as a group, as in (4.18a-c). Since phrasal constituents are normally frontable in German sentences, this distribution is consistent with an analysis where the path expressions form a phrase.

(4.18a) Auf den Tisch neben die Vase legte Hans das Buch
on the table next-to the vase laid Hans the book
It was on the table next to the vase that Hans laid the book

(4.18b) Aus dem Zimmer hinaus warf Maria den Ball
out the room out threw Maria the ball
It was out the room that Maria threw the ball

(4.18c) In den Garten hinaus sind die Kinder gelaufen
Into the yard out are the children run
Out into the yard ran the children

However, the fact that elements may occur fronted together is not sufficient to show that the elements form a phrase. Nerbonne (1994) provides an account of German partial verb phrase fronting where the fronted elements do not correspond to a single phrase in corresponding sentences where these elements are not fronted. According to Nerbonne, the fronted elements *das Buch lesen* in (4.19a) do not form a phrase when they occur in the Mittelfeld, as in (4.19b).

(4.19a) Das Buch lesen wird er schon können
the book read will he already can
He'll surely be able to read the book

(4.19b) Er wird schon das Buch lesen können
he will already the book read can
He'll surely be able to read the book

Path-denoting PPs sometimes occur fronted along with other verb dependents, but do not seem to form phrases in sentences that do not front these elements. In (4.20a) from Lühr (1985), the fronted elements *die Kinder nach Stuttgart* do not correspond to a phrase in (4.20b), where the elements occur in the Mittelfeld.

(4.20a) Die Kinder nach Stuttgart sollst du bringen
the kids to Stuttgart should you bring
You should bring the kids to Stuttgart.

(4.20b) Du sollst die Kinder nach Stuttgart bringen.
You should the kids to Stuttgart bring
You should to bring the kids to Stuttgart

Sentences (4.20c-d) below, again from Lühr (1985), provide examples similar to (4.20a) in that multiple verb dependents occur before the verb. In (4.20c), *befriedigt* 'satisfied' and *ins Bett* 'into bed' occur before the verb *legte* 'laid'. In (4.20d), *mit dem Auto* 'by car' and *nach Stuttgart* 'to Stuttgart' occur before the verb *sollst* 'should'.

(4.20c) Befriedigt ins Bett legte er sich, schlief gut, traumlos.
satisfied in bed laid he himself, slept well, dreamless
he went to bed satisfied, slept well, dreamless.

(4.20d) Mit dem Auto nach Stuttgart sollst du die Kinder bringen.
with the car to Stuttgart should you the kids bring
You should bring the kids to Stuttgart by car

Sentences with multiple fronted verb dependents are less common, but enough examples exist to cast doubt on frontability as an absolute test for constituency.

Sequences of path expressions commonly occur adjacent to each other, but adjacency is not mandatory, providing evidence that these sequences do not form phrases. In (4.21a), the prepositional phrase *von Berlin* 'from Berlin' occurs at the front, separate from *nach Leipzig* 'to Leipzig'. In (4.21b), the path PP *durch den Nebeneingang* occurs separate from auf den Sportplatz 'onto the sports field'. In (4.21c), the path phrases *von dort* 'from there' and *nach Oberwesel* 'to Oberwesel' are separated by the PP *mit einem Reindampfer* 'by steamboat' specifying the mode of transportation.

(4.21a) Von Berlin sind wir dann nach Leipzig gefahren
from Berlin are we then to Leipzig driven
From Berlin we then drove to Leipzig

(4.21b) Durch den Nebeneingang kommen die Spieler auf den Sportplatz
through the side entrance come the players onto the sports field
Through the side entrance come the players onto the field of play
(adapted from Hoberg 1981)

(4.21c) Mitglieder fahren von dort mit einem Rheindampfer nach Oberwesel.
Members travel from there with a Rhine steamer to Oberwesel
Members travel from there by steamboat to Oberwesel.

The fact that non-path verb dependents may intervene between path expressions provides evidence that sequences of path expressions do not form phrases. An analysis where each path PP is a distinct verb dependent predicts the sort of ordering possibilities exhibited in sentences (4.21a-c).

Sentences with sequences of path expressions are reminiscent of sentences like (4.22a-b) where multiple temporal expressions or multiple locative expressions occur to constrain a single period of time or a single location. Like path expression sequences,

sequences of locative or temporal expressions can be fronted as a group, but individual expressions may be fronted to the exclusion of others.

(4.22a) Maria sah das Auto um 5 Uhr am Montag
Maria saw the car at 5 o'clock on Monday
Maria saw Hans at 5 o'clock on Monday

(4.22b) Am Montag sah sie das Auto um 5 Uhr.
On Monday saw she the car at 5 o'clock
On Monday, she saw him at 5 o'clock.

(4.22c) Maria wohnte außerhalb der Stadt in einem kleinen Haus
Maria lived outside the city in a small house
Maria lived outside the city in a small house

(4.22d) Außerhalb der Stadt wohnte Maria in einem kleinen Haus
outside the city lived Maria in a small house
Outside the city, Maria lived in a small house

Sentences (4.21a), (4.22b), (4.22d) are similar in that one PP is fronted, separate from another PP with a similar semantics in the same sentence. In (4.21a), one path is fronted, separate from another path PP. In (4.22b), one temporal PP is fronted to the exclusion of another temporal PP. In (4.22d), one locative PP is fronted, separate from another locative PP.

These sentences also have something else in common. They are all appropriate in situations where a speaker wishes to distinguish between iterations of similar situations. Thus, for example, (4.22b) is appropriate in a discussion about multiple sightings of a car. The fronted temporal PP serves to distinguish one sighting from another (one sighting on Monday, another perhaps on Friday, etc), while the non-fronted temporal PP seems to be simply descriptive, not really distinguishing one sighting from another. In (4.22c), the implication is that Maria has multiple residences. *Außerhalb der Stadt* 'outside the city' serves to distinguish one residence from another, while the non-fronted PP is more

descriptive. In the path example of (4.21a), the implication is that there are multiple legs in a journey, which each leg being distinguished by its starting location. Even though PPs with similar semantics commonly occur together, the above examples show that common sentences exist where word ordering has PPs with similar semantics separated from each other.

Certain semantic restrictions hold for possible combinations of locative, temporal, and path expressions. For example, combinations like *um 5 Uhr um 6 Uhr* 'at 5 o'clock at 6 o'clock' or *in Berlin in Hamburg* 'in Berlin in Hamburg' or *zur Bank zur Post* 'to the bank to the post office' are clearly contradictory, since the constraints these combinations impose cannot be satisfied by a single point in time, a single location, or a single path. Semantic composition for temporal, locative, and path expressions is intersective, not conjunctive.

4.8 Multiple path expressions are not complement sisters to the motion verb

This section presents evidence against the Multiple Complement analysis where each path is a complement sister to the head motion verb. For example, in sentences (4.23a-c), the Multiple Complement analysis claims that the underlined elements are complements of the verb.

(4.23a) Maria legte das Buch <u>auf den Tisch</u> <u>neben die Vase</u>
Maria laid the book on the table next-to the vase
Maria laid the book on the table next to the vase

(4.23b) Maria warf den Ball <u>aus dem Zimmer</u> <u>hinaus</u>
Maria threw the ball out the room out
Maria threw the ball out of the room

(4.23c) Maria lief von dem Laden zur Post
Maria ran from the store to-the post office
Maria ran from the store to the post office

It has been shown in sections 4.1-4.6 that a single path expression like *auf den Tisch* 'on the table' is required to explicitly occur with some motion verbs in several contexts. Previous sections also argued that motion relations intrinsically involve path relations, so that paths are required in a semantic sense for all motion verbs.

However, in the case of multiple paths occurring with a single motion verb, there is no evidence that every path expression is required. Motion verbs like *legen* 'lay', *werfen* 'throw', *laufen* 'run' never require more than a single path expression. There are no contexts in which multiple paths must occur. In examples (4.23a-c), any individual path expression may be omitted, as long as at least one path occurs, as shown by (4.23d-l).

(4.23d) Maria legte das Buch auf den Tisch
(4.23e) Maria legte das Buch neben die Vase
(4.23f) *Maria legte das Buch

(4.23g) Maria warf den Ball hinaus
(4.23h) Maria warf den Ball aus dem Zimmer
(4.23i) Maria warf den Ball *(path must be inferred)*

(4.23j) Maria lief vom Laden
(4.23k) Maria lief zur Post
(4.23l) Maria lief *(path must be inferred)*

The Multiple Complement analysis does not predict this distribution of path expressions. Instead, it predicts that there ought to be contexts where all complements are required, as in the example of *geben* 'give', for which both the recipient and the given entity are sometimes required.

Previous sections argued that the notion of path is intrinsic to relations that denote

a change of location. Since motion is relative, some sort of path is required to indicate what entity the motion is relative to, and in what manner (away, through, to, etc).

However, the claim that multiple paths are intrinsic to motion relations is more difficult to argue. Specifying that the motion is relative to two entities in (perhaps) different ways does not serve to define a motion relation differently. It merely serves to specify the path of motion more specifically. In a semantic sense, path relations beyond one are optional.

4.9 One path is a complement, additional paths are adjuncts

This section argues that in sentences like (4.23a-c), one path expression is a complement, and any other path expressions are adjuncts. This analysis correctly predicts that one path is required, while additional paths are always optional.

In some cases it is possible to show which path must be the complement. Example sentences (4.24a-c) show that the path particle *entgegen* 'toward' is a complement, since *entgegen* is absolutely required. The path expression *aus dem Haus* 'out the house' is an adjunct in (4.24a), since it is optional, as shown in (4.24c).

(4.24a) Hans lief mir aus dem Haus entgegen
Hans ran me out the house toward
Hans immediately ran out of the house toward me

(4.24b) *Hans lief mir aus dem Haus
*Hans ran me out the house

(4.24c) Hans lief mir entgegen
Hans lief mir entgegen
Hans ran toward me

Examples like (4.24a-c) are the exception, rather than the rule. In general, it is difficult to show that a particular path expression is the complement. For example,

sentences (4.25a-d) show that while at least one path expression is required to occur with *legen* 'lay', no one path in particular is required. One might reason that because *auf den Tisch* 'on the table' is closely related to the resultant state of "lying on x" entailed by *legen*, *auf den Tisch* is therefore the complement. But (4.25c-d) shows that *auf den Tisch* is not required any more than paths like *neben die Vase* 'next to the vase'. Neither path appears to be specifically required by *legen*.

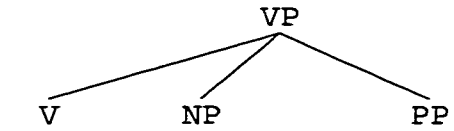
(4.25a) Maria legte das Buch auf den Tisch neben die Vase
Maria laid the book on the table nextto the vase
Maria laid the book on the table next to the vase

(4.25b) *Maria legte das Buch
Maria laid the book

(4.25c) Maria legte das Buch auf den Tisch
Maria laid the book on the table
Maria laid the book on the table

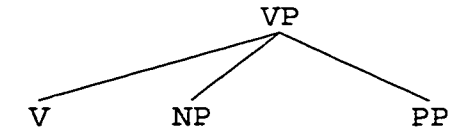
(4.25d) Maria legte das Buch neben die Vase
Maria laid the book nextto the vase
Maria laid the book next to the vase

The difficulty in distinguishing the complement path from adjunct paths leads to an ambiguous analysis where a path sentence has multiple syntactic and semantic structures, but all structures apparently correspond to a single set of truth conditions. For example, in sentence (4.25a), the syntactic and semantic structure of the *hd-comp-ph* differs, depending on which PP is the complement. Fig. 4.3 shows the syntactic structure of the *hd-comp-ph* when *auf den Tisch* is a complement. Fig. 4.4 shows the syntactic structure of the *hd-comp-ph* when *neben die Vase* is a complement.



legte das Buch auf den Tisch

Fig. 4.3: *auf den Tisch* as a complement



legte das Buch neben die Vase

Fig. 4.4: *neben die Vase* as a complement

Although (4.25a) has two distinct structures, the truth conditions for each variant are apparently the same. It does not matter if *neben the Vase* or *auf den Tisch* is the complement - sentences with both paths are true under the same conditions.

Section 4.10 Path-denoting Particles are Complements, but not Adjuncts

Motion verbs occur with one or more path-denoting prepositional phrases, as shown by examples (4.26a-b). In (4.26a), the motion verb *laufen* 'run' occurs with the complement path PP *aus dem Haus* 'out of the house'. In (4.26b), *laufen* occurs with *aus dem Haus* and *in den Garten* 'into the yard'.

(4.26a) Hans lief aus dem Haus
Hans ran out the house
Hans ran out of the house

(4.26b) Hans lief aus dem Haus in den Garten
Hans ran out the house in the yard
Hans ran out of the house into the yard

Unlike path prepositions, at most one path-denoting particle ever occurs with a motion verb, as shown by examples (4.27a-b). In (4.27a), the situation is the same as in

(4.26b), where Hans runs out of the house into the yard. However, the combination of *hinaus* 'out' and *hinein* 'in' is not acceptable.

(4.27a) *Hans lief hinaus hinein
Hans ran out in

Double path particles are not even possible if the expressed reference location of both particles is identical. In (4.27b), Hans is jumping off and out of the back of a truck, but the combination of the two path particles *hinaus* 'out' and *hinab* 'off' is not acceptable.[2]

(4.27b) *Hans sprang hinaus hinab
Hans jumped out off

This Single Particle Constraint does not appear to be related to some sort of limitation on the number of unexpressed reference locations. In (4.28a), the path particle *entgegen* 'toward' has an explicit reference location *ihrem Vater* 'her father', so there are no unexpressed reference locations. Yet double path particles are still not possible, as shown in (4.28b).

(4.28a) Maria lief ihrem Vater entgegen
Maria ran her father toward
Maria ran toward her father

(4.28b) *Maria lief ihrem Vater entgegen hinaus
Maria ran her father toward out

An analysis where path-denoting particles may only occur as complements predicts the Single Particle Constraint. Formally, this means that path particles never have a lexical variety with the MOD feature. Because motion verbs never subcategorize for more than

[2]More than one path particle can occur with a single motion verb if the particles are conjoined, as in *Hans lief hinaus und hinein* 'Hans ran out and in'. I assume this is an instance of ellipsis.

one path-denoting complement, only one path particle can possibly occur with a single motion verb. Path denoting prepositions, on the other hand, have both adjunct and complement variants in the lexicon, and thus more than one path PP may be licensed to occur with a single motion verb.

4.11 Conclusion

Single path expressions occurring with motion verbs are complements, as evidenced by the fact that in some circumstances, the path expression is absolutely required to form a grammatical sentence. In all circumstances, because motion relations entail path relations, the complementhood of single path expressions is at least plausible.

When multiple path expressions occur with a motion verb, only one path is a complement, while additional path expressions are adjuncts. Evidence shows that multiple path expressions do not form phrases, and an analysis where all path expressions are complements fails to predict that additional path expressions are never required under any circumstances. Path-denoting particles are licensed to occur as complements, but not adjuncts. This correctly predicts that no more than one path-denoting particle may occur with a motion verb.

Chapter 5: Semantic Structure Path Expressions with Motion Verbs

5.0 Introduction

This chapter presents a semantic analysis of path expressions with motion verbs. It is argued that path relations are referential, denoting a stretch of space (Piñon 1993, Jackendoff 1990). Fig. (5.1) shows the path relation for the German preposition *in* 'in'.

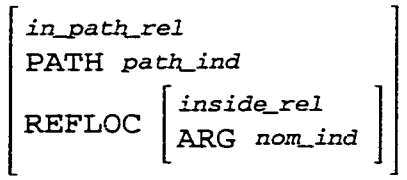


Fig. 5.1: *in_path_rel*

Motion verb relations here resemble those of Davis (1996), except that motion verb relations have the additional feature PATH. The value of PATH is an index of type *path_ind*, token-identical to the GND value of the motion verb. The index value of GND (and PATH) corresponds to the stretch of space traversed by the moving figure. PATH is necessary to accommodate the semantic composition of adjunct paths with the motion verb. Fig. (5.2) shows the verb relation for the manner-of-motion verb *laufen* 'run'. Fig. (5.3) shows the verb relation for the cause-motion verb *werfen* 'throw'.

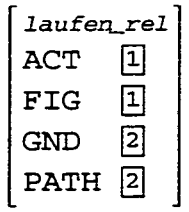


Fig. 5.2: *laufen_rel*

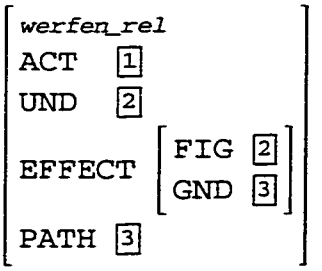


Fig. 5.3: *werfen_rel*

Semantic composition will be described in MRS (Minimal Recursion Semantics) notation as described in Sag and Wasow (1998) and Copestake, Flickinger, Sag (1997). Semantic composition of path expressions with motion verbs is ordinary, except that path expressions and motion verbs are associated by virtue of having token-identical PATH values. When multiple path expressions occur with a single motion verb as in (5.1), the motion relation and all path relations must have token-identical PATH values. This coindexing represents the constraint that all path expressions occurring with a motion verb must describe some aspect of the same path. In (5.1), both *aus dem Haus* and *in die Straße* describe different aspects of the same stretch of space. This constraint is similar to the Unique Path Constraint presented by Goldberg (1995).

(5.1) Maria lief aus dem Haus in die Straße
Maria ran out the house in the street
Maria ran out of the house into the street

Coindexing of PATH values is specified either in the COMPS value of the head in the case of complement paths, or the MOD value of the adjunct in the case of adjunct paths. A motion verb specifies that the PATH value of its complement path is token-identical to the GND and PATH values in the verb relation. Adjunct paths specify that their PATH value is token-identical to the value of PATH in the head phrase's KEY relation.

Semantic selection is also ordinary. A motion verb selects an appropriate semantic type of complement path by specifying the KEY value of the complement in the verb's COMPS list. An adjunct path selects an appropriate type of motion verb by specifying the KEY value of the head in the adjunct path's MOD value.

Section 5.1 argues against a FIG/GND analysis of path expression semantic content as presented in Davis (1996) or Verspoor (1997). This section argues that the semantic content of path expressions is more general, and that the semantic composition they present does not extend well to multiple paths. Section 5.2 presents a referential representation of path relations, as suggested in Piñon (1993) and Jackendoff (1990). According to this view, path relations refer indefinitely to stretches of space, and are defined with respect to a location. This section introduces and justifies the feature PATH for path relations, needed to correctly model semantic composition of multiple path expressions. Path-denoting prepositions and particles have the same sort of semantic content, but differ in their valence. Prepositions require an NP complement, while particles do not select complements. Section 5.3 presents motion verb relations. I adopt the view that motion entailment is a lexical property of the verb, as in Levin & Rappaport Hovav (1995). According to Davis (1996), motion verbs have internal semantic structure that varies according to verb type. This variation in internal structure complicates adjunct-style semantic composition because paths are associated with a part of the verb semantic content, rather than the whole content. This section introduces the feature PATH for motion verb relations that provides the consistent structure necessary for adjunct modification. Section 5.4 presents an account of semantic composition for motion verbs and path expressions. Composition is represented in MRS (Minimal Recursion Semantics) fashion as

the list-append of RESTR lists. Multiple path expressions are coindexed because they denote the same stretch of space. Section 5.5 shows how motion verbs select semantically appropriate complements, and how adjunct paths select semantically appropriate motion verb phrases. This section argues that constraints on possible combinations of path expressions with a single verb do not need to be represented formally, since these constraints follow from the possible coindexing of paths. Section 5.6 concludes this chapter.

5.1 Problems with a FIG/GND representation of path relations

Davis (1996) represents the semantic structure of English path prepositions like *from*, *into*, *around* as a subsort of *fig_gnd_rel*, as shown in fig. 5.4. This representation claims that a path-denoting preposition relates a figure (an indexed in the situation) to a path.

$$\begin{bmatrix} \textit{from\_rel} \\ \text{FIG} \ \textit{nom-ind} \\ \text{GND} \begin{bmatrix} \textit{from\_path\_rel} \\ \text{SOURCE} \ \textit{place} \end{bmatrix} \end{bmatrix}$$

Fig. 5.4: semantic relation for PP *from*

Fig. 5.4 closely resembles Davis' proposal for the representation of motion verbs with embedded paths, like *enter*. Fig. 5.5 shows the *enter_rel*. No features serve to distinguish the *enter_rel* from path-denoting PP relations, unless one assumes different sorts with identical features. Davis does not explicitly say whether or how path-denoting PP relations are distinct from motion verb relations.

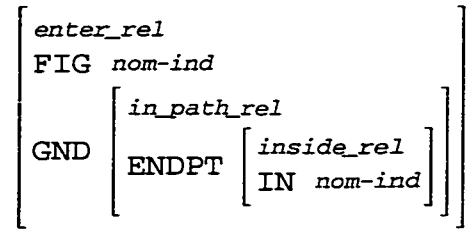


Fig. 5.5: *enter* relation

Verspoor (1997) offers a similar representation of path-denoting PP semantic content, again as a sort of *fig_gnd_rel*. Verspoor explicitly claims that the *fig_gnd_rel* in path-denoting PPs is a type of motion relation, the *go_rel*. In this view, path prepositions inherently entail that some entity moves. The fact that a motion verb like *run* may or may not entail motion, while *run* with a path PP always entails motion, follows from the embedded motion relation in the path PP. Fig. 5.6 shows Verspoor's CONT | NUC value for the path preposition *to*.

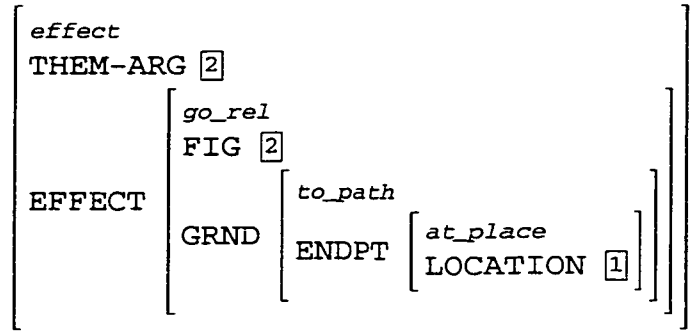


Fig. 5.6: CONT| NUC value for *to*

Representing path preposition relations as subsorts of *fig_gnd_rel* associates a figure (an indexed entity) with a path. This association is characteristic for motion verbs like *laufen* 'run' (where the figure is identified with the subject) and *werfen* 'throw' (where the figure is identified with the accusative object). However, this association of path with a distinguished figure is not evident when paths occur with verbs like *schauen* 'look', *sehen*

'see', *scheinen* 'shine', *schießen* 'shoot' that denote directed activities without entailing movement. In each sentence (5.2a-c), the subject does not occupy or move along the path, so the subject does not play a figure role. These examples suggest that a fig/gnd analysis of path prepositional content is too specific. The fig/gnd relation is a property of motion verbs, not path-denoting expressions.

(5.2a) Maria schaute aus dem Fenster
Maria looked out the window
Maria looked out the window

(5.2b) Maria sah durch das Fernglas
Maria saw through the telescope
Maria looked through the telescope

(5.2c) die Sonne scheint durchs Fenster
the sun shines through-the window
the sun is shining through the window

Both Verspoor and Davis present accounts of semantic composition where a single path PP structure-shares its content with some part of the verb content. Although neither account explains semantic composition of multiple paths, Davis suggests that paths have the features SOURCE, VIA, and ENDPT, as shown in fig. 5.7.

$$\begin{bmatrix} \textit{path\_rel} & \\ \text{SOURCE} & \textit{place} \\ \text{VIA} & \textit{place} \\ \text{ENDPT} & \textit{place} \end{bmatrix}$$

Fig. 5.7: features of *path_rel*

In this model, path-denoting prepositions like *into* constrain the endpoint of the path, prepositions like *through* constrain some intermediate points of the path, and prepositions like *out* constrain the starting point of the path. Fig. (5.8-5.10) show representations the semantic relations *in_path*, *out_path*, and *through_path*. If each path

contributes semantic content by structure-sharing its content with that of the verb, then a unified path would look like fig. (5.11).

$$\begin{bmatrix} \textit{in\_path} \\ \text{ENDPT} \begin{bmatrix} \textit{inside\_place\_rel} \\ \text{INSIDE } \textit{nom\_ind} \end{bmatrix} \end{bmatrix}$$

Fig. 5.8: the relation *in_path*

$$\begin{bmatrix} \textit{out\_path} \\ \text{SOURCE} \begin{bmatrix} \textit{outside\_place\_rel} \\ \text{OUTSIDE } \textit{nom\_ind} \end{bmatrix} \end{bmatrix}$$

Fig. 5.9: the relation *out_path*

$$\begin{bmatrix} \textit{through\_path} \\ \text{VIA} \begin{bmatrix} \textit{inside\_place\_rel} \\ \text{INSIDE } \textit{nom\_ind} \end{bmatrix} \end{bmatrix}$$

Fig. 5.10: the relation *through_path*

$$\begin{bmatrix} \textit{out\_through\_in\_path\_rel} \\ \text{SOURCE} \begin{bmatrix} \textit{outside\_place\_rel} \\ \text{OUTSIDE } \textit{nom\_ind} \end{bmatrix} \\ \text{VIA} \begin{bmatrix} \textit{inside\_place\_rel} \\ \text{INSIDE } \textit{nom\_ind} \end{bmatrix} \\ \text{ENDPT} \begin{bmatrix} \textit{inside\_place\_rel} \\ \text{INSIDE } \textit{nom\_ind} \end{bmatrix} \end{bmatrix}$$

Fig. 5.11: Unified path relation

This account of path content composition does not describe the actual combinations of path expressions that commonly occur. Assuming that the features ENDPT, VIA, and SOURCE each take a single path relation as their value, this account predicts that at

most one path expression may constrain the source, at most one path expression may constrain intermediate points, and at most one path expression may constrain the endpoint. This is too restrictive. In (5.3a), the path expressions *aus dem Haus* 'out of the house' and *hinaus* 'out' both constrain the source. In (5.3b), the path expressions *über das Feld* 'across the field' and *durch den Tunnel* 'through the tunnel' constrain intermediate points of the path, while *nach Hause* '(to) home' constrains the endpoint. In (5.3c), the path expressions *auf den Tisch* 'on the table' and *neben die Vase* 'next to the vase' constrain the endpoint.

(5.3a) Hans lief aus dem Haus hinaus
Hans ran out the house out
Hans ran out of the house

(5.3b) Hans lief durch den Tunnel über das Feld nach Hause
Hans ran through the tunnel across the field to home
Hans ran home through the tunnel across the field

(5.3c) Hans legte das Buch auf den Tisch neben die Vase
Hans laid the book on the table next-to the vase
Hans laid the book on the table next to the vase

In order to extend this analysis to cover all the various possible combinations of path expressions, features beyond SOURCE, VIA, and ENDPT would have to be added to the point of having a distinct feature for virtually every path-denoting preposition and particle. For example, since the preposition *aus* 'out' and the particle *hinaus* 'out (away from speaker)' may both occur simultaneously with the same motion verb, one would have to split the SOURCE feature into several features (or subfeatures), one for each possible path word, as in Fig. 5.12. The ellipsis (...) in fig. 5.9 indicates that this list would have to be expanded to include other source paths, like *von* 'from'. The more features you have to add, the more the *path_rel* object is reduced to an inventory of possible path relations.

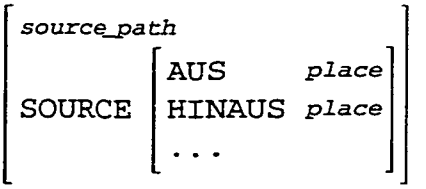


Fig. 5.12: source path relation

5.2 Path Relations

Fig. 5.13 defines the sort *path_rel*, the sort of semantic relation appropriate for path-denoting prepositions and particles.

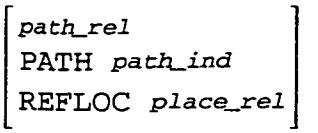


Fig. 5.13: sort declaration for *path_rel*

This representation of path relations claims that a *path_rel* is referential, meaning that the relation refers to or denotes an entity in the external world. The value of the feature PATH is of the type path index (*path_ind*). An index is a marker assigned to entities in an utterance to show identity or difference of reference. Here, the path index corresponds to the unique stretch of space traversed by the moving figure. According to Piñon (1993), paths refer indefinitely to a quantity of space that extends between a starting point and ending point.

Paths are defined with respect to a reference location, here represented as the feature REFLOC. The value of REFLOC is a place relation (*place_rel*). Place relations are simply locative relations, familiar from locative prepositions like *at, inside, outside*, etc. Place relations are defined with respect to some entity -- one is *outside*, *inside*, or *at* some point,

area, or space. Path relations are defined with respect to a specific sort of *place_rel*. In fig. 5.14, the path-denoting preposition *aus* 'out' is defined with respect to the place relation *outside_rel*. The *outside_rel* is in turn defined with respect to some indexed entity represented here as [1]. In fig. 5.15, the path-denoting preposition *zu* 'to' is defined with respect to the place relation *at_rel*.

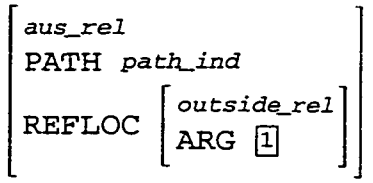


Fig. 5.14: the *aus* relation

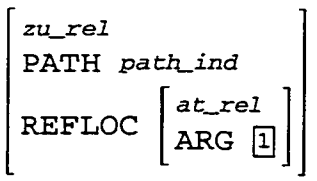


Fig. 5.15: the *zu* relation

The *path_rel* depicted here has a more general meaning than those presented in section 5.1 in that they do not include a FIG/GND relation or an EFFECT relation. I assume that associating a path with a moving figure is characteristic of motion verb relations (see section 5.3 for details of motion verb relations).

The feature PATH in path relations is needed to describe the Unique Path Constraint. In cases where more than one path expression occurs as a sister to the verb head, each path expression must describe some aspect of the same unique stretch of space. This constraint predicts that sentences like (5.4) are unacceptable. Since a single continuous

stretch of space can have at most one endpoint, (5.4) is impossible because it specifies two distinct endpoints.

(5.4) *Maria fuhr zur Bank zur Post
Maria drove to-the Bank to-the post office

In order to model the Unique Path Constraint, it is useful to assign an index to the unique stretch of space described by each path expression, in addition to the indices assigned to each path expression. The value of the feature PATH in path relations (and in motion relations; see section 5.3) is an index of type *path_ind* corresponding to this unique path. The constraint is described in terms of coindexing PATH values. All path expressions and the head verb must have token-identical PATH values.

Both path-denoting prepositions and particles include *path_rels* in their semantic content. Both particles and prepositions are defined with respect to some reference location. For prepositions, this reference location is explicitly specified by the NP complement governed by the preposition. For example, in a prepositional phrase like *aus dem Zimmer* 'out of the room', *Zimmer* 'room' serves as a semantic argument in the *outside_rel* embedded in the *aus* relation. Path-denoting particles differ from prepositions in that they do not govern complements. For particles, the value of the reference location is implied. For example, in a sentence like *Hans lief hinaus* 'Hans ran out', the reference location for the path particle *hinaus* is unspecified. It is not explicitly said where Hans is running from, and the listener must infer this to understand the utterance.

Multiple paths that occur with a single motion verb must describe some aspect of the same unique stretch of space. In formal terms, the PATH value of each path will be token-identical. The paths are then said to be coindexed, because they share the same PATH

value. Section 5.4 presents a formal account of semantic composition for multiple paths, including an account of how paths are coindexed.

5.3 Motion relations

Figures (5.16-5.18) show structures of three types of motion verb relations. These representations resemble those proposed by Davis (1996) except for the addition of the feature PATH. Fig. (5.16) shows the semantic relation for the manner-of-motion verb *laufen* 'run'. Fig. (5.17) shows the semantic relation for the cause-motion verb *werfen* 'throw'. Fig. (5.18) shows the semantic relation for the placement verb *legen* 'lay'.

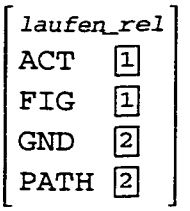


Fig. 5.16: *laufen_rel*

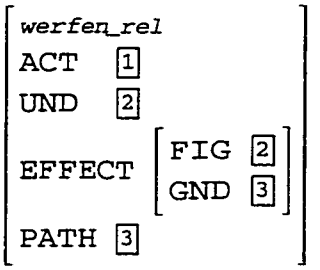


Fig. 5.17: *werfen_rel*

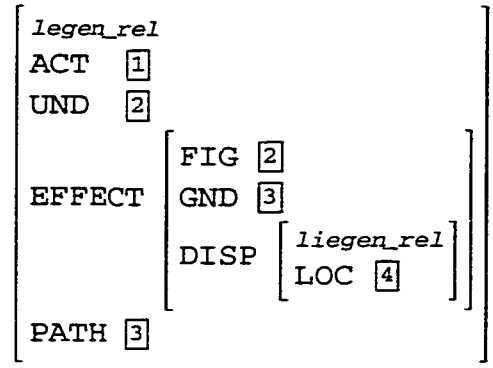


Fig. 5.18: *legen_rel*

Davis (1996) explains many of these roles[1] and how they are assigned to various entities involved in a situation. Fig. (5.19) gives a short summary of the roles and their entailments.

ACT	Actor	typically volitional, sentient participant, cause events
UND	Undergoer	causally affected, undergoes change of state
EFFECT	Effect	the result of a causal event
FIG	Figure	an entity that changes location with respect to GND
GND	Ground	stationary reference frame. A path.
DISP	Disposition	placement verbs embed a disposition relation, a way of occupying a location.

Fig. 5.19: Summary of path roles in motion verbs

The relations in (5.16-5.18) vary in structure as well as type. Verbs that entail movement have FIG and GND roles somewhere, but precisely where these roles occur varies by relation type. The *werfen* relation entails motion as a result of causative action, so the FIG and GND roles are embedded as the value of EFFECT. The *laufen* relation has FIG and GND

[1]The roles DISP and PATH are my own inventions.

roles that appear at the same level as the ACT role.

This variety in the placement of the GND role in motion relations poses complications for the integration of adjunct path expression semantic content with that of the verb. As argued in chapter (4), some path expressions are adjuncts. Adjuncts differ from complements in that it is the adjunct, not the head verb, that specifies how semantic content integrates. Assuming that the adjunct should associate its own semantic content with the GND feature of the motion verb, complications then arise because the location of GND in the verb relation differs by verb type. Unless changes are made to the representations of motion relations, the MOD value of a path adjunct that modifies a manner-of-motion verb like *laufen* (fig. 5.20) will differ from the MOD value of a path adjunct that modifies a cause-motion verb like *werfen* (fig. 5.21).

$$\text{MOD}\left[\text{CONTENT} \mid \text{KEY}\left[\begin{array}{l}\textit{motion\_rel}\\ \text{EFFECT} \mid \text{GND}\ \boxed{1}\end{array}\right]\right]$$

Fig. 5.20: MOD value for path expression modifying a cause-motion relation

$$\text{MOD}\left[\text{CONTENT} \mid \text{KEY}\left[\begin{array}{l}\textit{motion\_rel}\\ \text{GND}\ \boxed{1}\end{array}\right]\right]$$

Fig. 5.21: MOD value for path expression modifying a manner-of-motion relation

No evidence exists supporting the notion that path adjuncts differ according to the type of motion verb they modify. For example, we do not find certain paths that only occur with causative motion verbs, but not manner-of-motion verbs.

In order to avoid these spurious multiple types of path expression adjuncts, I propose the addition of the PATH feature, resulting in a slightly flattened version of Davis'

verb relation representations. The PATH aspect of the semantic structure remains constant, making it possible to have just one sort of path expression modifier. As already shown in Fig. (5.13-5.15), the lexical entry of the motion verb specifies that the value of PATH is token-identical to the value of GND, wherever GND might be found. With the addition of PATH, the value of MOD for all path expressions that modify motion verbs has the form shown in fig. (5.22).

$$\text{MOD}\left[\text{CONTENT} \mid \text{KEY}\left[\begin{array}{l}\textit{motion\_rel}\\ \text{PATH}\ \boxed{1}\end{array}\right]\right]$$

Fig. 5.22: uniform MOD value for all path expression adjuncts

5.4 Semantic composition of motion verbs with path expressions

The semantic composition of motion verbs with path expressions follows ordinary principles for composition of headed phrases. The MRS version of semantic composition presented here follows Sag & Wasow (1998) and Copestake, et. al. (year?).

Fig. (5.23) shows the Semantics Principle for headed phrases, adapted from Copestake et. al. The restriction list of the phrase, the RESTR feature, represents restrictions or constraints on the denotation of the phrase. The RESTR value of the phrase is the list-append of the RESTR lists of the head daughter and the non-head daughter, plus any construction-specific content (see chapter 2 for an overview of MRS semantics). In this way, roughly speaking, the meaning of the whole phrase is the sum of its parts. The KEY value of the phrase distinguishes a relation in the RESTR list to be used for semantic selection. The KEY value of a phrase is token-identical to the KEY value of the head daughter. The INDEX value of the phrase corresponds to Davidsonian-style event variable, and is token-identical to the construction content, if present. When CONST-CONT is empty,

the INDEX value of the phrase is normally token-identical to the INDEX value of the head daughter.

$$\left[\begin{array}{l} \textit{phrase} \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{CONT} \mid \left[\begin{array}{l} \text{INDEX } \boxed{4} \\ \text{KEY } \boxed{1} \\ \text{RESTR } \boxed{2} \oplus \boxed{3} \oplus \boxed{5} \end{array}\right] \\ \text{HEAD-DTR} \mid \text{SYNSEM} \mid \text{LOCAL} \mid \text{CONT} \mid \left[\begin{array}{l} \text{KEY } \boxed{1} \\ \text{RESTR } \boxed{2} \end{array}\right] \\ \text{NON-HEAD-DTR} \mid \text{SYNSEM} \mid \text{LOCAL} \mid \text{CONT} \left[\text{RESTR } \boxed{3}\right] \\ \text{CONST-CONT} \left[\begin{array}{l} \text{INDEX } \boxed{4} \\ \text{RESTR } \boxed{5} \end{array}\right] \end{array}\right]$$

Fig. 5.23: Semantics Principle

Fig. 5.24 shows the semantic composition of the motion verb *laufen* 'run' with *hinaus* 'out'. The "..." notation abbreviates detail that has been left out.

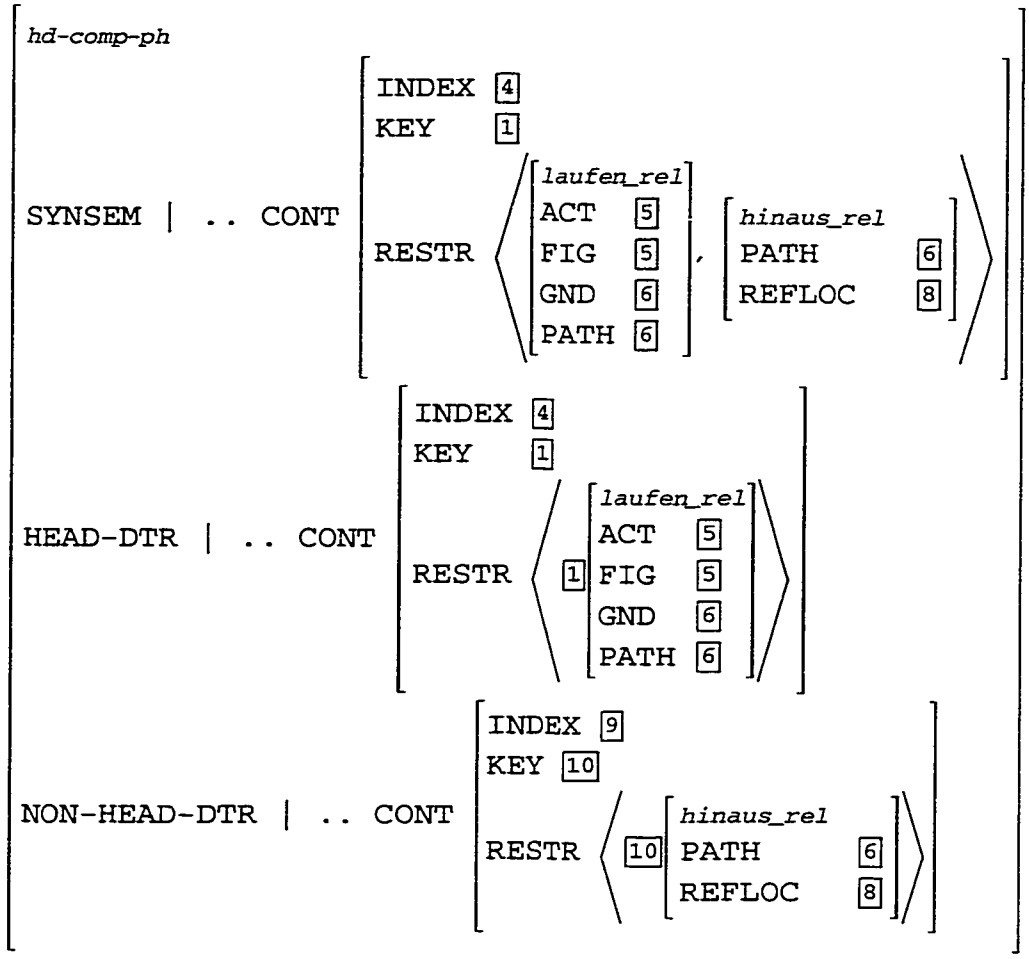


Fig. 5.24: Semantic Composition of *laufen* 'run' and *hinaus* 'out'

Fig. 5.24 shows that the PATH value of the complement path expression *hinaus* is token-identical to the GND and PATH values in the *laufen_rel*. This represents the fact that *hinaus* describes some aspect of the unique path associated with the GND and PATH roles in the motion verb relation. This association (identity) is specified in the lexical entry of the motion verb, as shown in fig. 5.25. The value of SUBJ is a noun phrase with an INDEX value of [1], token-identical to the values of the ACT and FIG roles. The value of COMPS is a particle phrase whose PATH value is [2], token-identical to the values of GND and PATH. The lexical

entry of the verb specifies that the value of PATH and GND are token-identical.

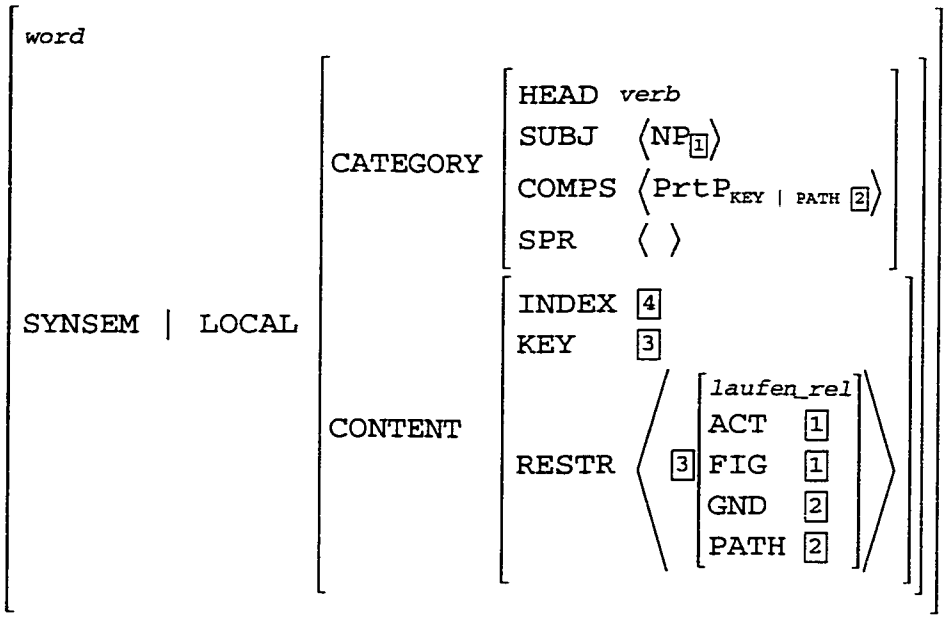


Fig. 25: Associating the complement path with PATH and GND.

The way that complement paths are associated with roles in motion verb relations differs from the way that most complements are associated with roles in verb relations in that the value of PATH is shared, rather than the INDEX value of the complement path. Informally, this analysis specifies that motion verb relations are defined with respect to a unique path index that does not correspond to any phrase in the sentence. Path expressions are associated with the motion verb by virtue of the fact that they describe some aspect of the same unique path.

For adjunct paths, it is the lexical entry of the head of the adjunct path that associates the path with the PATH role of the verb. The head feature MOD specifies what the adjunct modifies. Fig. 5.26 shows the lexical entry for the adjunct path preposition *aus* 'out'. The MOD value of *aus* specifies that *aus* modifies a verb whose KEY relation is of type

motion_verb_rel, and whose PATH value is token-identical to its own PATH value. Since every adjunct will associate its own PATH value with that of the PATH role in the verb relation, it then follows that all paths (adjunct and complement) will be coindexed, meaning that they have token-identical PATH values.

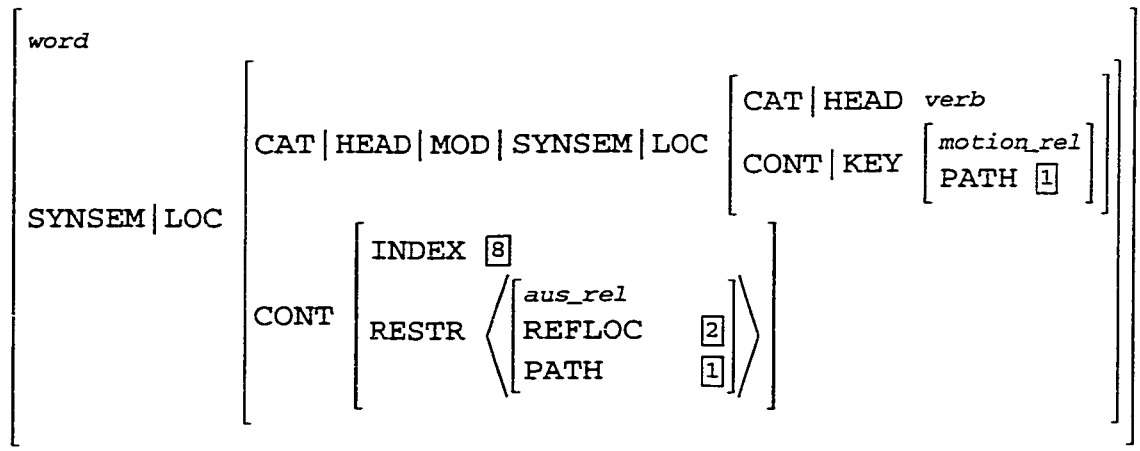


Fig. 5.26: Associating the adjunct path with the PATH role

5.5 Constraints on combinations of path expressions

Examples (5.5-6) show that the combination of multiple path expressions with a single motion verb is restricted. Examples (5.5a-b) show that the manner-of-motion verb *fahren* 'drive' may occur with the path expression *zur Bank* 'to the bank', but may not occur simultaneously with *zur Bank* 'to the bank' and *zum Post* 'to the post office.' Examples (5.6a-b) show that the placement verb *legen* 'lay' may occur with the path expression *auf den Tisch* 'on the table', but may not occur with the path expression *vom Boden* 'from the floor.'

(5.5a) Maria fuhr zur Bank
Maria drove to-the bank
Maria drove to the bank

(5.5b) *Maria fuhr zur Bank zum Post
Maria drove to-the bank to-the post office

(5.6a) Hans legte das Buch auf den Tisch
Hans laid the book on the table
Hans laid the book on the table

(5.6b) *Hans legte das Buch vom Boden
Hans laid the book from-the floor

Both the speaker's knowledge of the real world and the definition of a path together predict the sort of constraints illustrated in (5.5-6). Multiple paths must all describe (different) aspects of one unique path (Unique Path Constraint). Because a path, by definition, has just one endpoint, sentences like (5.5b) are impossible, since each path expression defines the endpoint in a contradictory manner.[2]

Sentences like (5.5b) are not ungrammatical. Rather, they are nonsensical because they do not correspond to possible situations. If one is able to imagine a world where a single entity literally occupies multiple locations, then perhaps sentences like (5.5b) make sense, and would be more precise than the conjoined version *zur Bank und zur Post*, for which a serial interpretation is more obvious.

The preposition *zu* 'to' specifies a specific endpoint for a path, but other prepositions like *hinter* 'behind', *in* 'in, into', *auf* 'on, onto' constrain the endpoint of the path to a certain region of space, rather than a specific point. Multiple paths can thus logically constrain the endpoint if their regional constraints overlap. For example, sentence (5.7) is acceptable if the endpoint of the path is located both behind the house and in the yard at the same time.

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[2]It is possible to combine *zur Bank* and *zum Post* if the path expressions are conjoined by *und* 'and'. I assume that this is an ellipsis construction, describing two distinct situations, each with a different path.

(5.7) Der Hund lief hinter das Haus in den Garten
the dog ran behind the house in the yard
The dog ran behind the house into the yard

Even *zu* 'to' can occur with prepositions like *hinter* 'behind' and *in* 'into' if *zu* specifies an endpoint that falls within the regional constraints imposed by the other prepositions, as shown in (5.8).

(5.8) Der Hund lief hinter das Haus in den Garten zu seinem Herrn
The dog ran behind the house into the yard to his master
The dog ran behind the house into the yard to his master

Placement verbs like *legen* 'lay' impose constraints on path combinations beyond the logical constraints of the real world. Examples (5.9a-f) show that *legen* is simply incompatible with a variety of path expressions.

(5.9a) *Maria legte das Buch vom Boden auf den Tisch[3]
Maria laid the book from the floor onto the table

(5.9b) *Maria legte das Buch aus der Küche
Maria laid the book out the kitchen

(5.9c) *Maria legte das Buch ihrem Vater entgegen
Maria laid the book her father toward
**Maria laid the book toward her father*

(5.9d) *Maria legte das Buch zur Bank
Maria laid the book to-the bank

(5.9e) *Maria legte das Buch durchs Fenster auf den Tisch
Maria laid the book through-the window on the table

The placement verb *legen* is compatible with paths that constrain the endpoint to a region of space, as shown in example sentences (5.10a-d).

---

[3]This sentence is unacceptable unless *vom Boden* is an adjunct sister of *das Buch*.

(5.10a) Hans legte das Buch auf den Tisch
Hans laid the book on the table
Hans laid the book on the table

(5.10b) Hans legte das Buch neben die Vase
Hans laid the book next-to the vase
Hans laid the book next to the vase

(5.10c) Hans legte das Buch hinein
Hans laid the book in
Hans laid the book in

(5.10d) Hans legte das Buch hinter die Lampe
Hans laid the book behind the lamp
Hans laid the book behind the lamp

Intuitively, placement verbs like *legen* are semantically compatible with prepositions like *auf* 'on' because the notion of placement is concerned with the spatial orientation of a moved figure at the endpoint of motion. At the end of a *legen* situation, the moved entity must by lying on something, which may or may not be explicitly specified. Movement from a starting point or along an intermediate path is external to the notion of placement. A situation where an entity has not yet come to rest at an endpoint is not a placement situation, and so the starting point or intermediate points of the course of motion are not relevant to placement. Manner of motion situations are different, in that the moving entity does not have to arrive at an endpoint in order to be a manner of motion situation.

The straightforward way to model placement verb constraints on path combination is to exploit the semantic typing of verb and path relations. Placement verbs also form a semantic class. Path expressions that occur with *legen* form a semantic class in that they all constrain the endpoint of the path to a region of space, rather than to a point. Formally, these constraints are codified in the lexical entries of placement verbs and path-denoting prepositions and particles. For example, the lexical entry of the placement verb *legen* 'lay'

specifies that its complement must be of the appropriate type, and the lexical entry of path words like *von* 'from', *zu* 'to', *aus* 'out' would exclude the possibility that they could modify phrases headed by placement verbs.

In order to identify those path-denoting semantic relations that are compatible with *legen*, it is useful to classify path relations along two dimensions. The path-bounds dimension, shown in fig. 5.27, classifies path relations according to the way they constrain the bounds of a path. Path relations define the starting section of a path, an intermediate section, or an ending section. This classification is similar to that of Davis (1996).

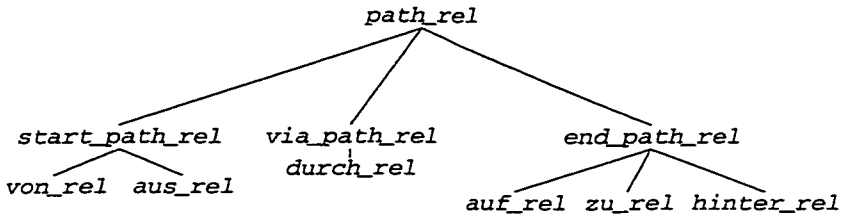

Fig. 5.27: hierarchy of path relations typed by path-bounds

Only path relations of the type *end_path_rel* are compatible with placement verbs, so path relations like *aus_rel* and *durch_rel* are excluded. However, the class of *end_path_rel* is not specific enough to describe compatibility with placement verbs, since *end_path_rels* like the *zu_rel* are incompatible with *legen*.

Path relations like the *zu_rel* differ from relations like *auf_rel* in that the *zu_rel* is defined by a locative relation like the English *at_rel*. The endpoint of motion for the *zu_rel* is viewed as a point (like a point on a map), rather than constraining the endpoint to a region of space. Path relations like the *auf_rel* are defined by a locative relation like the English *on_rel* that constrains location to a region of space. This distinction defines the

second dimension, the point/space dimension, as shown in fig. 5.28. Paths defined by the *at_rel* are *point_path_rels*. Paths defined by other locative relations are *space_path_rels*.

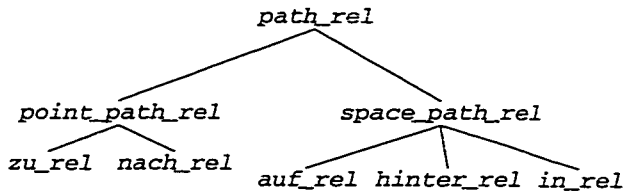

Fig. 5.28: Hierarchy of path relations typed by point/space dimension

Only paths of the type *space_path_rel* are compatible with *legen*. The point/space dimension, like the path-bounds dimension, does not define the class of *path_rels* that are compatible with *legen*, since *space_path_rels* include relations like the *aus_rel* that do not occur with *legen*. But both dimensions taken together do exactly identify the appropriate class of relations.

5.6 Conclusion

Path relations refer indefinitely to continuous stretches of space. Path relations do not themselves entail motion or relate a distinguished figure to a ground frame. Path relations are defined with respect to locations. Multiple path expressions occurring with a single motion verb each describe some aspect of the same unique stretch of space. This Unique Path Constraint is represented as a coindexing of values for the feature PATH in path complements, path adjuncts, and motion verbs.

A decomposed representation of motion verb relations requires motion relations to have a feature like PATH in order to present a consistent structure amenable to modification. Semantic composition of path expressions with motion verbs is ordinary. Indices corresponding to individual path expressions are not directly associated with a role

in motion relation of the head verb. Instead, path expressions are semantically associated with motion verbs by virtue of describing some aspect of the same unique path that defines the course of motion for the moving figure in the motion relation.

Verb types like manner of motion verbs and cause-motion verbs impose no constraints on combination of paths beyond those imposed by the definition of a path and the Unique Path Constraint. Verbs like placement verbs exhibit a more restricted compatibility with path relations. The simplest way to describe these restrictions is to exploit the semantic typing of motion relations and verbs.

Chapter 6: Conclusion

6.0 Summary of findings

In chapter (3), it was argued that the simpler account for combinations of particles with verbs as in examples (6.1a-b) is an account where the combination is a phrase, rather than a word. In both examples, the motion verb *laufen* 'run' occurs with the path particle *hinein* 'in'. In (6.1a) the preterite form *lief* 'ran' occurs as a finite verb, separated from hinein. In (6.1b), *lief* occurs at the end of a dependent clause, written together with *hinein* without an intervening space, in accordance with standard German orthography.

(6.1a) Maria lief sofort hinein
Maria ran immediately in
Maria ran in immediately

(6.1b) ... daß Maria sofort hineinlief
... that Maria immediately in-ran
... that Maria ran in immediately

The phrasal account correctly predicts that particles and verbs may not always occur adjacent to each other. The difference between main clause word order and dependent clause word order in German perfectly predicts the position of the finite verb. An analysis where the combination of particle and verb is a single word does not predict the discontinuity in (6.1a). In general, the ordering of sublexical units is not sensitive to the type of clause in which they occur. In the one-word analysis, discontinuous words in sentences like (6.1a) represent curious exceptions to the generalization that morphological rules license the combination and ordering of morphemes in words, while syntactic rules license the combination and ordering of words in phrases.

The phrasal account also correctly predicts that the *ge-* prefix in past participle forms will occur between the particle and the verb as shown in example (6.2), since the *ge-*

prefix attaches to words, not phrases. In (6.2), the *ge-* prefix occurs after the particle *hinein*. The position of *ge-* does not follow from the one-word account, since *ge-* otherwise only occurs initially in past participles.

(6.2) Hans ist schon hineingelaufen
Hans is already in-run
Hans has already run in

The occurrence of the *ge-* prefix is in general determined by the stress pattern of the base form of the verb, including any prefixes that might be present. The phrasal account correctly predicts that the stress pattern of the particle has no role in predicting when the *ge-* prefix will occur, because it is the stress pattern of the verb itself that is relevant, not the stress pattern of words that might occur with the verb. An account where particles are sublexical elements must view particles as exceptions, since the stress properties of sublexical units are otherwise relevant in determining whether the *ge-* prefix occurs.

In general, the *zu* infinitival marker occurs immediately preceding the verb in German. The phrasal account also correctly predicts that the *zu* infinitival marker will occur between the particle and the verb, as in *abzulaufen* 'to run off', because the particle always occurs immediately preceding the verb, but not before other words that might occur with the verb. An account where the particle and the verb form a single word must treat infinitival forms of particle verb constructions as an exception to the otherwise generalization that the infinitival marker *zu* does not intervene between sublexical units.

Chapter (3) also argued that the fact that many particle verb combinations bear conventionalized semantics is not evidence that particles are either words or sublexical

elements. Conventionalized semantic content is the norm in combinations of sublexical units, but conventionalized content is also commonly associated with phrases as well.

A number of German nouns, adjectives, and adverbs are derived from particle verb combinations. For example, the noun *Ausfahrt* 'exit, offramp' is related to the particle verb combination *ausfahren* 'drive out'. If one assumes that word formation rules may not relate words to phrases, then the productivity of certain particles in word formation represents an exception to this generalization.

However, the No Words From Phrases generalization is appears to be more of a trend than a rule, since several kinds of German words appear to be related to phrases, words like *Kurzparker* 'short-term parker', similar to a combination of adverb and verb, *Umweltzerstörung* 'destruction of the environment', which is similar to a combination of a verb with its complement. In fact, virtually any phrase can be nominalized by preceding the string with das 'the', as in *das Aufdensteinensitzen* 'the sitting on the rocks'.

The subcategorization requirements for a verb sometimes change when a particle occurs with the verb, apparently similar to cases where a prefix is added to a verb stem, but chapter (3) argues that changes in subcategorization requirements do not necessarily show that particles must be sublexical elements like prefixes. Variation in subcategorization requirements is also explained if particles are themselves subcategorized by the verb. For example, *laufen* by itself does not normally license a dative object, but the occurrence of *nach* 'after' with the verb *laufen* 'run' requires the co-occurrence of a dative object, as in example (6.3). This co-occurrence requirement is explained if the lexical entry for this variety of *laufen* subcategorizes for both *nach* and the dative object. It does not necessarily show that *nach* or the dative object are sublexical elements.

(6.3) Maria lief dem Mann nach
Maria ran the man after
Maria ran after the man.

Finally, chapter (3) argues that path particles ought to be considered a subtype of adverb, in order to distinguish them from locative and temporal particles or intensifiers. No further distinction in head type need be made. Any further predictions concerning the distribution of path particles follows from their grammatical relation to the verb (either adjunct or complement) and their semantic content.

Chapter (4) offers an account of the phrase structure for motion verbs occuring with path particles and path-denoting prepositional phrases. Chapter (4) concludes that the grammatical relation between the motion verb and path-denoting expression is sometimes that of head-adjunct, sometimes head-complement. The following constraints describe the phrase structure of path-denoting prepositional phrases and/or path particles with motion verbs.

Motion verbs occur with just one complement path expression. Additional path expressions are adjuncts. No more than one path expression is a complement. This accounts for verbs like *legen* 'lay' which can require that a path expression occurs, but optionally allow additional any number of additional path expressions.

Many path particles may only occur as complements, but not adjuncts. Formally, most path particles do not have a lexical variant with a MOD value. This explains why most path particles may only occur singly with a motion verb. A few path particles like *links* 'left' occur both as adjuncts and complements, like path-denoting prepositional phrases.

Chapter (4) argues against three plausible alternate phrase structures, the Single-

Phrase analysis where path expressions combine with each other to form more complex path expressions, the All-Complement analysis where all path expressions are complement sisters of the head verb, and the All-adjunct analysis where all path expressions are adjuncts. Chapter (4) shows that individual path-denoting prepositional phrases and particles need not occur adjacent to each other in some contexts, as in example (6.4). The fact that other words and phrases can intervene between individual path expressions shows that they do not form a syntactic unit, providing evidence against the Single-phrase analysis.

(6.4) Von Hamburg fuhren wir dann nach Berlin
From Hamburg drove we then to Berlin
From Hamburg we then drove to Berlin

Some motion verbs clearly require a path expression to co-occur, providing evidence that the path expression is a complement in these cases. For example, (6.5a-b) show a case where the path particle *entgegen* 'toward' is required by the motion verb *laufen* 'run'.

(6.5a) Hans lief seinem Vater sofort entgegen
Hans ran his father immediately toward
Hans ran immediately toward his father

(6.5b) *Hans lief seinem Vater sofort
Hans ran his father immediately

Chapter (4) argues that the semantic contribution of a single path expression to the motion verb relation is always best described in a head-complement relation, since the very definition of motion crucially involves some path. Thus, in sentences like (6.6a) where change of location is entailed without an explicit path, chapter (4) argues that a null

complement exists which remains unexpressed, but is recoverable from the context. Sentences like (6.6b) have the same structure, except that the complement occurs explicitly. This analysis argues against the All-adjunct model, since at least one path must be a complement.

(6.6a) Hans sah den Bären. Dann lief er.
Hans saw the bear. Then ran he
Hans saw the bear. Then he ran

(6.6b) Hans sah den Bären. Dann lief er weg.
Hans saw the bear. then ran he away
Hans saw the bear. Then he ran away.

Chapter (4) argues that every motion verb relation requires just one complement path, no more and no less. Any additional path expressions (beyond the complement) are adjuncts. This analysis is motivated by the fact that while motion verbs may often require at least one path expression to occur, it is never the case that a motion verb requires more than one path expression. For example, the verb *legen* 'lay' requires at least one compatible path expression, but optionally allows additional path expressions, as shown in example (6.7) below. Optionality, as defined in chapter (4) is taken to be a significant characteristic defining the difference between complements and adjuncts.

Chapter (5) presents an analysis for the semantics of path expressions with motion verbs. Path relations are referential, denoting a stretch of space, and are defined with respect to locations. For example, a prepositional phrase like *ins Haus* 'into the house' refers to a stretch of space extending to a location inside the house. Path relations for particles are the same as for prepositions. The difference between path-denoting prepositions and particles is that prepositions require NP complements, while particles may not. Chapter (5) argues against an analysis where path-denoting prepositions and particles inherently

include a distinguished figure (FIG) role, arguing instead that the close association of a distinguished figure with path expressions is a lexical characteristic of motion verbs, but not characteristic of all types of verbs. In (6.7a), the path expression *aus dem Fenster* 'out the window' is closely associated with *Hans*, as it describes his trajectory of motion. This close association is a lexical property of the motion verb *springen* 'jump'. In (6.7b), the path expression is identical, and is associated more closely with the direct object *Ball* 'ball' than with the subject *Hans*. In (6.7c-d), no distinguished figure exists. Neither the subject nor the object NP is closely associated with the path expression.

(6.7a) Hans sprang aus dem Fenster
Hans jumped out the window
Hans jumped out of the window

(6.7b) Hans warf den Ball aus dem Fenster
Hans threw the ball out the window
Hans threw the ball out of the window

(6.7c) Hans schaute aus dem Fenster
Hans looked out the window
Hans looked out the window

(6.7d) Hans beobachtete den Mann von seinem Fenster
Hans observed the man from his window
Hans observed the man from his window

Motion relations have a PATH role, whose value is an index corresponding to the trajectory of the moving figure in the real world. Path expressions are associated with motion relations by sharing token-identical PATH values. Thus, all path expressions occuring with a single motion verb will have token-identical PATH values, as they all describe (different) aspects of the same unique path through space.

Chapter (5) also presents a fairly straightforward account of semantic selection for motion verbs and path expressions. Verbs like *legen* 'lay' are compatible with some sorts of

path relations, but not others. As in English, in German one can lay a book *auf den Tisch* 'on the table', but not *aus der Büchertasche* 'out of the bookbag'. A semantic classification of motion relations and path relations makes it possible to specify which sorts of path expression are compatible.

6.1 Why these ideas matter, and possibilities for further research

One significant contribution of this thesis is that it offers an analysis of path particles that is integrated with an analysis of path-denoting prepositions. This integrated analysis shows that path particles and prepositions resemble each other in their semantic relations and in their potential for combining with motion verbs. Indeed, since path-denoting prepositional phrases and particles commonly occur together with motion verbs, an integrated analysis seems quite natural.

This sort of integrated analysis would be useful in the study of other types of particles in German. Path particles are just one type of particle that occur with verbs in German. Some particles combine with verbs like noun complements, as in example (6.8a) where the particle *Rad* 'bike' combines with the verb *fahren* 'drive'. Other particles resemble adjectives, denotiong resultative states, as in (6.8b) where *auf* 'up, open' occurs with *machen* 'make, do'. Other particles make an aspectual contribution to the situation denoted by the verb, as in (6.8c) where *auf* 'up' occurs with the verb *essen* 'eat'.

(6.8a) Hans fährt gern Rad
Hans drives gladly bike
Hans likes to ride his bike

(6.8b) Maria machte das Fenster auf
Maria made the window up
Maria opened the window

(6.8c) Maria aß alles auf
Maria ate everything up
Maria ate up everything

Studies like this thesis that describe the syntactic and semantic structure of particle verbs in conjunction with an analysis of similar constructions like NP complementation or resultatives might provide simpler and more explanatory analyses of particle verb constructions than studies that focus on properties that particle verbs exhibit across types.

Developing an integrated analysis for path particles and prepositions led to an important contribution to the study of path-denoting expressions, namely a general analysis for multiple path-expressions occurring with a single motion verb, and a formal representation of the Unique Path Constraint. The final analysis for multiple path-expressions presented in this thesis is surprising in that it claims that the grammatical relation between path expressions and the motion verb vary in the same sentence, so that one path expression is a complement, while any additional paths are adjuncts.

6.2 Speculation on a few unanswered questions

6.2.1 Why do certain path particles acquire conventional semantic content more readily than path-denoting prepositional phrases?

Combinations of certain path particles with motion verbs exhibit conventional semantic content more often than do combinations with path-denoting prepositional phrases. For example, the combination *weg+werfen* 'throw away' means something like 'discard', in addition to its literal meaning. The combination *ein+fahren* 'drive in' sometimes has the additional non-literal entailment that the vehicle has arrived at its destination. In the combination *aus+stellen* 'put out for display', the entailment that the moved figure is for display does not follow from either *aus* or *stellen*. Combinations with

particles like *an* 'at, on', *auf* 'on, up', *aus* 'out', *ein* 'in' appear to be more likely to have non-conventional meanings than particles like *hinein* 'in away from speaker', *heraus* 'out toward speaker'. The path particle combinations that are more likely to have non-conventional meanings are appear more often as elements in word formation.

I would speculate that path particle combinations acquire non-conventional meanings more easily because the reference location that answers the question 'out of where? into where? onto where?' is not specified, but must be inferred from context. This lends the particle verb combination the flexibility to appear in a wide variety of contexts, even abstract or figurative contexts, as long as the listener is reasonably able to infer the reference location, which may be abstract as well.

Particles like *an, auf, aus, ein* may be more likely to acquire non-conventional meanings because they compete with *her-* and *hi-* variants like *heron*, *handful*, *heraus*, *hinein*. These *her-* and *hi-* variants denote literal paths, since morpheme *hi-* indicates a path away from the speaker, while the morpheme *her-* indicates a path toward the speaker. Because these literal variants exist, particles like *an, auf, aus, ein* have become associated with non-conventional combinations.

6.2.2 Why do (almost) all path particles occur as complements, but not adjuncts?

As shown in chapter (4), most path particles will not occur in conjunction with other path particles, as shown in (6.9).

(6.9) *Hans sprang auf hinein
Hans jumped up in

Certain particles like *links, rechts* 'left, right' do occur in conjunction with other particles, as shown in (6.10).

(6.10) Biegen Sie dann links ein!
Turn you then left in
Then you turn left

The reason that multiple path particles do not usually occur with a single verb is related to two tendencies or constraints on describing paths with more than one path expression. First, it sounds odd to have path expressions use the same reference location. Sentences like *Hans lief ins Zimmer durchs Zimmer* 'Hans ran into the room through the room' sound odd. If sentences like (6.9) were to have an interpretation, in my judgement it seems that an interpretation where both particles share the same reference location is the only one possible. I'm not sure why a serial interpretation is not possible, except perhaps that a serial interpretation using the conjunction und 'and' is often possible, as in *Hans sprang hinauf und hinaus* 'Hans jumped up and out'.

The difference between *links* 'left' and *hinein* 'in' relates to the fact that *hinein*, like most path particles, has an unexpressed reference location that must be inferred from context. *Links* is instead always defined with respect to the spacial orientation of some object, typically the moving figure in motion situations. There is no unexpressed location, and thus words like *links* may occur as adjuncts or complements.

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Vita

James Patrick Witte was born in Hastings, NE on Nov. 13, 1965. He received his high school diploma from St. Cecilia HS in Hastings, NE in 1984. He received several scholarships at graduation, including a National Merit scholarship. He attended the University of Nebraska-Lincoln, studying German, Mathematics, and Physics, and spent a year abroad in Regensburg, Germany. He received his Bachelor of Arts in 1989. He started his graduate study in German at the University of Illinois Urbana-Champaign in 1989, and received his Master of Arts degree in 1991. He spent another year abroad in Heidelberg in 1992, and started his studies for the Ph.D. in 1993. He currently works as an instructional computing consultant for the Language Learning Laboratory, University of Illinois Urbana-Champaign. Jim and his wife Mary Jo Licht have 2.5 cats, and currently live in Champaign, IL.